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TRANSACTIONS OF THE

SECTION ON

Preventive Medicine and Public Health

of the
American Medical Association
at the Seventieth Annual
Session, held at Atlantic City,
N. J., June 9 to 13, 1919

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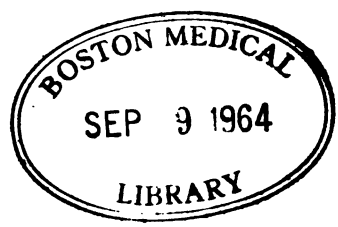

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LIST OF OFFICERS

Those named below have served as officers in this section. This branch of the practice of medicine has been included with other subjects in the earlier years, as will be seen by the headings which denote the different names given to the section. The names of the officers have been taken from the published records, which are deficient in some cases. It will be appreciated if any additional data are brought to the attention of the Secretary of the American Medical Association.

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Delegate, N. S. Davis, Jr., Chicago.

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Delegate, C. St. Clair Drake, Springfield, Ill.

CONTENTS

PAGE

List of Officers 5

Proceedings of the Section 11

Chairman's Address: The Influencee of the War on Preventive Medicine and Public Health. C. St. Clair Drake 17

New Jersey's Work in Mosquito Control. William Edgar Darnall 26

The Demand for Community Nursing Service During the Reconstruction Period. B. R. Wakeman 39

General Health Activities and Their Effect on Tuberculosis Mortality. George Thomas Palmer 54

The Influenza Epidemic and Its After-Effects in the City of Buffalo. A Detailed Study. Franklin C. Gram ... 62

Progress of Venereal Disease Control. C. C. Pierce .. 80

Open Air Classes. Leopold Marcus 99

Experiments to Determine Mode of Spread of Influenza. Milton J. Rosenau 109

The Epidemiology of Influenza. W. H. Frost 116

Bacteriology of Recent Pandemic of Influenza and Complicating Infections. William H. Park 133

The Symptomatology and Complications of Influenza. Lewis A. Conner 142

Studies in Influenza and Pneumonia. IV. Further Results of Prophylactic Inoculations. E. C. Rosenow and B. F. Sturdivant 158

Status of Prophylactic Vaccination Against Influenza. G. W. McCoy 176

Value of Convalescent Blood and Serum in Treatment of Influenzal Pneumonia. Henry F. Stoll 188

Treatment of Influenza by Means Other than Vaccines and Serums. James B. Herrick 204

Lethargic Encephalitis. Josephine B. Neal 222

Index 239

PROCEEDINGS OF THE SECTION

WEDNESDAY, JUNE 11—MORNING

The meeting was called to order at 9 a. m. by the chairman, Dr. C. St. Clair Drake, Springfield, Ill.

Dr. C. St. Clair Drake read as the chairman's address a paper on "The Influence of the War on Preventive Medicine and Public Health." The paper was discussed by Drs. J. P. Davin, New York, and C. C. Pierce, Washington, D. C.

Dr. Juan Guiteras, Havana, Cuba, read a paper on "Public Health Problems of the Southern Countries." Discussed by Dr. N. T. McLean, U. S. Navy; Mr. L. I. Dublin, New York, and Dr. Juan Guiteras.

Dr. Juan Guiteras, Havana, Cuba; Sir Arthur Newsholme, England, and Capt. Réné Sand, Brussels, Belgium, were nominated for Honorary Fellowship in the Association. Dr. John P. Davin, New York City, introduced the following preambles and resolution which were ordered transmitted to the House of Delegates:

WHEREAS, The conditions of the public health in Porto Rico are deplorably deficient, and

WHEREAS, These arise from the very high prevalence of such preventable diseases as typhoid fever, malaria, diarrhea and enteritis, measles, infantile tetanus and others which have been proved to be subject to ready control by public health workers;

WHEREAS, These conditions have arisen out of the lack of adequate appropriations for public health work and out of the lack of health facilities such as sufficient health officers, private physicians, nurses, hospitals, clinics and other agencies;

WHEREAS, These conditions are becoming progressively worse and beyond control of sanitary officers; and

WHEREAS, Porto Rico is a dependency of the United States and looks to the United States for its public health work; be it

Resolved, That the Section of Preventive Medicine and Public Health of the American Medical Association puts itself on record as deploring the woeful conditions in the island of the public health; and be it further

Resolved, That the Secretary of the Association direct the attention of the Secretary of War to these conditions and to urge the Secretary to include in his next budget sufficient provision for the conduct of adequate health work and, further, the Bureau of Insular Affairs of the War Department be asked to call upon the Surgeon-General of the U. S. Public Health Service to send a group of sanitary officers to Porto Rico to survey the conditions, to report on the health needs and to institute proper measures for the control of those conditions.

(Not transmitted to the House of Delegates.)

Dr. William E. Darnall, Atlantic City, N. J., read a paper on "What New Jersey Has Done in Mosquito Extermination." Discussed by Drs. B. Franklin Royer, Philadelphia; Juan

Guiteras, Havana, Cuba; Dr. John A. Ferrell, New York; J. D. McLean, Harrisburg, Pa.; John P. Davin, New York; Arthur T. McCormack, Bowling Green, Ky., and William E. Darnall, Atlantic City, N. J.

A resolution endorsing a bill pending in Congress providing for physical education, etc., was introduced, approved and referred to the House of Delegates.

Resolved, That the American Medical Association hereby approves and indorses said bill with the full belief that it is necessary for the protection of the public health, and urges that the Congress of the United States give it favorable consideration; and be it further

Resolved, That a copy of these resolutions be forwarded to each member of Congress, and that a committee of three be appointed to represent the Association to assist in bringing to the attention of Congress facts and conditions which prove the necessity for the enactment of this law.

(Not transmitted to the House of Delegates.)

Dr. A. T. McCormack, Bowling Green, Ky., moved that a representative of the American Medical Association be appointed as a member of the National Council on Public Health Education. The motion was seconded and carried and ordered referred to the House of Delegates. (Not submitted to the House of Delegates.)

Dr. Bertis R. Wakeman, Hornell, N. Y., read a paper on "The Demand for Community Nursing Service in Rural Districts."

The secretary, Dr. D. B. Lowe, Akron, Ohio, presented the proposed By-Laws for the section adopted at the February meeting of the secretaries of the sections. On motion duly seconded and carried the By-Laws were adopted as read.

The paper by Dr. Allen W. Freeman, Columbus, Ohio, on "Ohio's Health Plan" was called. The paper was not read but the subject was discussed by Dr. J. N. Hurty, Indianapolis; Mr. John A. Lapp, director of the Health Insurance Commission of Ohio, and Drs. Hastings, Canada; John P. Davin, New York; C. St. Clair Drake, Springfield, Ill.; Arthur T. McCormack, Bowling Green, Ky.; Otto P. Geier, Cincinnati; J. F. Hogan, Baltimore; Harold B. Wood, Providence, R. I.; L. L. Lumsden, Washington, D. C.

The chair appointed as a nominating committee Drs. Arthur T. McCormack, Bowling Green, Ky.; Guy L. Kiefer, Detroit, and L. L. Lumsden, Washington, D. C.

Thursday, June 12—Morning

The meeting was called to order at 9 o'clock by the chairman.

The following officers were elected: chairman, Dr. James A. Hayne, Columbia, S. C.; vice chairman, Dr. John D. McLean, Harrisburg, Pa.; secretary, Dr. Clarence D. Selby, Toledo, Ohio; delegate, Dr. C. St. Clair Drake, Springfield, Ill.; alternate, Dr. W. S. Rankin, Raleigh, N. C.

Dr. George Thomas Palmer, Springfield, Ill., read a paper on "General Health Activities and Their Influence on Tuberculosis Mortality." Discussed by Drs. L. L. Lumsden, Washington, D. C.; Juan Guiteras, Havana, Cuba; John P. Davin, New York; William C. Woodward, Boston; Arthur T. McCormack, Bowling Green, Ky., and George Thomas Palmer, Springfield, Ill.

A resolution offered by Dr. L. L. Lumsden, Washington, D. C., was discussed by Mr. Frederick L. Hoffman, Newark, N. J., and Drs. J. P. Davin, New York; C. St. Clair Drake, Springfield, Ill.; Wilfred H. Kellogg, San Francisco; S. L. Jepson, Charleston, W. Va.; L. D. Rawlings, Chicago; J. D. McLean, Harrisburg, Pa.; William C. Woodward, Boston; Oscar Dowling, Shreveport, La.; D. B. Lowe, Akron, Ohio, and L. L. Lumsden, Washington, D. C. The resolution, which is as follows, was referred to the House of Delegates.

Resolved, That the Section on Preventive Medicine and Public Health of the American Medical Association recommend to the House of Delegates that it ask the constituent association to consider the advisability of such amendments to their by-laws and to those of this Association as will eliminate from membership any physician who wilfully fails or refuses to comply with local or state laws for the prevention of disease, including especially the provisions in such laws requiring the reporting of cases of communicable disease.

(Not transmitted to the House of Delegates.)

Dr. Franklin C. Gram, Buffalo, read a paper on "The Aftermath of Influenza."

Mr. Frederick L. Hoffman, Newark, N. J., discussed the subject "Some Practical Statistics of Influenza Morbidity and Mortality."

This topic was discussed by Drs. A. Leo Franklin, Cumberland, Md.; E. B. Freilich, Chicago; Bertis R. Wakeman, Hornell, N. Y.; Sir Arthur Newsholme, England; Victor C. Vaughan, Ann Arbor, Mich.; Wilfred H. Kellogg, San Francisco; Harold B. Wood, Providence, R. I.; Mr. L. I. Dublin, New York; Dr. Hastings, Toronto, Canada; Mr. Frederick L. Hoffman and Franklin C. Gram, Buffalo.

Dr. C. C. Pierce, Washington, D. C., read a paper on the "Progress of Venereal Disease Control." Discussed by Dr. Wilfred H. Kellogg, San Francisco; A. E. Chase, Texarkana; Franklin L. Gram, Buffalo; L. D. Rawlings, Chicago, and C. C. Pierce, Washington, D. C.

Dr. H. A. Streator, Boston, presented the following preambles and resolutions. Discussed by Dr. J. W. Schereschewsky, Washington, D. C., when they were referred to the House of Delegates.

WHEREAS, The U. S. Public Health Service has given numerous convincing demonstrations of what could actually be accomplished by well planned public health activities toward aiding the nation's war activities; and,

WHEREAS, There is urgent need for the continuation of similar health activities to meet the postwar conditions, now existing; and

WHEREAS, The U. S. Public Health Service has made strenuous efforts to meet the demands of a national health service, and could meet these demands through active and effective cooperation with state and local health agencies if sufficient funds were available; therefore be it

Resolved, That it is the desire of this Association to express its interest in public health by urging on the congress of the United States the importance of providing the opportunity asked by the U. S. Public Health Service in the pending Sundry Civil act to enable that Service to meet the responsibilities placed on it by Congress and by the present existing conditions, and to cooperate properly with states; be it further

Resolved, That a copy of this resolution be sent to each member of Congress, urging that no reduction be made in the modest estimates submitted by the United States Public Health Service for funds required to continue its important activities, in protecting the health of the nation.

(Not transmitted to the House of Delegates.)

Dr. Leopold Marcus, New York, read a paper on "Open Air Classes in New York City." Discussed by Miss Annie Morrison, Grand Rapids, Mich.

Dr. Josephine B. Neal, New York, read a paper on "Encephalitis Lethargica." Discussed by Dr. J. F. Hogan, Baltimore.

FRIDAY, JUNE 13—AFTERNOON

A joint meeting was held with the Sections on Pathology and Physiology and Pharmacology and Therapeutics.

The meeting was called to order at 2 p. m. by Dr. W. A. Bastedo, New York, chairman of the Section on Pharmacology and Therapeutics.

The following papers were read as a symposium on "Influenza":

Dr. Milton J. Rosenau, Boston: "Experiments on Volunteers to Determine the Mode of Spread of Influenza."

Dr. Wade H. Frost, Washington, D. C.: "Epidemiology of Influenza."

Dr. William H. Park, New York: "The Bacteriology of Influenza and Its Complications."

Dr. William G. MacCallum, Baltimore: "The Pathology of Influenza."

These four papers were discussed by Drs. Augustus Wadsworth, Albany, N. Y.; Anna W. Williams, New York; Edwin R. LeCount, Chicago; Henry Albert, Iowa City, Iowa; Alexander Lambert, New York, and Harold B. Wood, Providence, R. I.

Dr. C. D. Selby, Toledo, Ohio, submitted the following preambles and resolution and moved that they be transmitted to the House of Delegates with the request that the House shall take action in accordance therewith. Seconded and carried.

WHEREAS, The recent influenza epidemic caused approximately 500,000 deaths in the United States; and

WHEREAS, A large proportion of these deaths were produced by pneumonia and other complications; and

WHEREAS, Influenza, pneumonia, and allied diseases now cause approximately one-tenth of all the deaths in the United States; and

WHEREAS, Medical science is not yet in possession of complete data as to the cause, modes of transmission, prevention, and cure of this disease and its complications; and

WHEREAS, The possession of this knowledge is of grave social and economic concern to the nation; therefore be it

Resolved, That it is the sense of those in attendance at this meeting of the sections on pharmacology and therapeutics, physiology and pathology, preventive medicine and public health, assembled to discuss influenza, that Congress should be and is hereby urged to appropriate not less than $1,500,000 to be used under the direction of the U. S. Public Health Service for the investigation of the causes, modes of transmission, prevention and cure of influenza, pneumonia, and allied diseases, this sum to be made available to July 1, 1922.

(Not transmitted to the House of Delegates.)

The symposium on "Influenza" was resumed:

Dr. Lewis A. Conner, New York: "The Symptoms and Complications of Influenza."

Drs. Edward C. Rosenow and B. F. Sturdivant, Rochester, Minn.: "Further Studies on Prophylactic Inoculation in Influenza and Pneumonia."

Dr. George W. McCoy, Washington, D. C.: "Present Status of Prophylactic Vaccination Against Influenza."

Dr. Henry F. Stoll, Hartford, Conn.: "Value of Convalescent Blood and Serums in the Treatment of Influenzal Pneumonia."

Dr. James B. Herrick, Chicago: "The Treatment of Influenza by Means Other Than Vaccine and Serums."

These five papers were discussed by Drs. Frank W. Hartman, U. S. Navy; Solomon Solis Cohen, Philadelphia; H. I. Goldstein, Camden, N. J.; Frederick T. Lord, Boston; Albert E. Roussel, Philadelphia; Will Walter, Chicago; M. K. Wylder, Albuquerque, N. M.; William C. Woodward, Boston; C. C. Browning, Los Angeles; H. H. Koons, Los Angeles; W. A. Bastedo, New York; George W. McCoy, Washington, D. C.; Edward C. Rosenow, Rochester, Minn., and James B. Herrick, Chicago.

THE INFLUENCE OF THE WAR ON PREVENTIVE MEDICINE AND PUBLIC HEALTH *

C. ST. CLAIR DRAKE, M.D.
SPRINGFIELD, ILL.

Those who have observed the thought and tendencies in preventive medicine of the present time must be impressed that the war will mark a definite turning point in public health activity and that there lies before us a period of reconstruction and reorganization in methods of health administration. The dominant thoughts underlying this readjustment are that both military and industrial power are dependent on man power and that the strength and efficiency of our man power will be determined, in the last analysis, by the health of the individual. In this readjustment, and born of our war-time experiences, disease prevention will be regarded as more important than disease suppression, and health promotion will take precedence over both. The public health administration of the future will be a forward-looking administration. While giving attention, as it has in the past, to the specific sources of illness, it will devote itself largely to the prevention of human ailments by the development of maximum health and, in pursuing this policy, it will deal with the individual more than ever before.

During the war, health became a matter of the utmost importance. It acquired a new practical value which, for the first time in our national life, has come to be appreciated by all intelligent people. The war also gave us some valuable and, incidentally, some disconcerting facts in regard to the physical condition and health of the people, and afforded an opportunity to

* Chairman's address.

try out the efficiency of modern preventive measures unrestricted and unhampered by prejudice, ultraconservatism or narrow opinion. As never before, public health work was given adequate financial backing. Efforts in disease prevention were made without the embarrassments arising from considerations of cost. For the first time we were able to demonstrate in a large way that good health is actually a purchasable commodity, and the American people have passed favorable judgment on the results of that demonstration.

This progressive policy, adopted in dealing with the health of the military forces, was doubtless due, to a large extent, to the fact that we were enabled to observe the experiences of European warring nations for some time before we became participants and, further, that we entered the war at a critical period when everything depended not only on the character of our military forces, but also on the productive ability of our industries. We had been awakened to the urgent necessity for the maximum of nation-wide physical efficiency.

The people as a whole have learned a new lesson as to the importance of individual and national health in time of war. They have also had it impressed on them that, while hostilities have ceased, the war is not over—that the period of reconstruction will make large demands on the physical resources of the nation—and they stand ready to continue and extend those health activities which have proved effective during the past two years.

The finding of the exemption boards and of army medical examiners came as a first awakening shock, disclosing, as they did, a surprising prevalence of physical disability, largely preventable in character, leading to the rejection, in the average community, of almost 20 per cent. of the young men who were presented for military service. These findings, incidentally, demonstrated conclusively the value of one of

the modern means of health promotion too generally ignored in the past—the periodic, physical examination of presumably healthy persons for the detection of early disease.

Of the disclosures made by the various examining boards, none excited more general comment than that of the great prevalence of venereal diseases and tuberculosis—the two diseases which, in many ways, have been longest neglected in our public health activities. The grave apprehension which had already attached to tuberculosis in the European nations and the prompt action in the United States, in providing a large corps of tuberculosis experts for army service and in establishing large sanatoriums for returned consumptive soldiers, changed the attitude of the American people very radically toward that disease and indicated the necessity for more extensive antituberculosis activities in the future. States and communities in which restrictions and regulations for the control of tuberculosis have been largely ignored on account of indifference or prejudice now find the people and the medical profession ready and anxious for any reasonable restrictive action. In one state alone, the lessons from the war have made such impression that while few public sanatoriums existed prior to that time, forty such institutions have been created by popular vote within the past two years, each with its attendant dispensaries and community nursing service.

RECOGNITION OF IMPORTANCE OF VENEREAL DISEASES

The awakening to the importance of venereal diseases and the change in public sentiment in regard to them have been even more spectacular. Health officers and the general public have always been reluctant to deal with these ailments frankly, and the campaigns of education have been generally half-hearted and weak. Certain press associations, reflecting the commonn sentiment of a few years ago, passed resolutions disap-

proving the use of the words "gonorrhea" and "syphilis" in the public prints. In view of this timid policy, and possibly as a result of it, the recently published statements of Vaughan and Palmer[1] are significant. While all other communicable diseases which sorely beset the armies during the Civil War have been greatly decreased and, in some instances, practically eliminated, there was found to be a very large increase in gonorrhea in the army of 1917 as compared with 1861.

The manner in which the federal government, through its military medical departments and under the provisions of the Kahn-Chamberlain law, have attacked the venereal disease problem, not only of soldiers, but also of the civil population, established a new policy and line of action from which the health officers of the future will never recede. Venereal diseases are being discussed before general audiences without hesitation, and educational and restrictive measures are being carried out such as would not have been possible had it not been for the accent placed on the subject when the nation was at war. The method of dealing with individuals who are presumably spreaders of venereal infection is a striking index of our entirely changed point of view. In many communities, prostitutes are now being apprehended, but, instead of being fined or committed to jail, which could have no influence whatever on the prevention of disease, these unfortunate women are sentenced, but the sentence is suspended so that they may be committed to general hospitals for treatment and from which they are discharged only when they have clinically recovered or when the best obtainable evidence indicates that they are no longer sources of infection. This is another indication, incidentally, of the individualization in health work which will unquestionably be a large factor in the health programs of the future.

1. Vaughan, V. C., and Palmer, G. T.: Communicable Diseases in the National Guard and National Army of the United States During the Six Months from September 29, 1917, to March 29, 1918, J. Lab. & Clin. Med. **3**: 635 (Aug.) 1918.

CHILD WELFARE WORK

The acute problem that has confronted the European nations, particularly France and Belgium, of a decreasing birth rate and a greatly increased mortality, has attracted world-wide attention and has centered unusual interest on the field of child welfare, and this interest has been accentuated by the realization that much of the physical inefficiency disclosed by examining boards might have been avoided had there been more intelligent thought on the subject of child conservation in the past. It is, of course, generally recognized that the span of human life has been increased about six years during the past generation and that it is possible further to extend life expectancy; and it is further recognized that this gain in the life period is largely due to the prevention of infant mortality, so that child welfare work appears at present to be the most hopeful field for public health endeavor and the one promising the most direct and definite returns.

In the attempt to reduce infant mortality, as carried on throughout the nation today, the chief efforts are directed toward keeping the well baby well, following the policy of health promotion rather than that of direct disease prevention; and the public health organizations are devoting themselves to the development of the individual child through better baby conferences, infant welfare stations, community nurses and other factors that are relatively new to public health organizations.

EXTENSION OF CLINICAL ACTIVITIES

This individualization in health work, illustrated in what has been done during the war in tuberculosis, venereal diseases and child welfare, foretells a definite new departure in the public health administration of the future—the development of extensive clinical activities. In the past, with certain exceptions, health departments have taken no part in diagnosis except in

the contagious and infectious diseases of epidemic type and through the services of diagnostic laboratories. If the policies adopted both here and abroad during the war are to be continued and extended, it seems inevitable that health authorities must render increased diagnostic and clinical services, including the early diagnosis essential to recovery from tuberculosis; the diagnosis of venereal diseases and the treatment of such cases especially for indigent persons; the development of well baby clinics and clinics for the reeducation of victims of poliomyelitis, on the diagnosis and treatment of trachoma, and so on. To carry out this work successfully, the various health departments will be compelled to employ physicians of highly specialized skill, and will necessarily have to make provision for far more generous compensation than is customary among public health agencies at the present time.

This extension of clinical service by health authorities, contrary to the opinion occasionally expressed, will prove directly beneficial to the medical profession as a whole. It is a matter of common agreement, wherever such public clinical work is undertaken, that, as a result of its educational influence, there is a decided and immediate increased demand for professional service among the patients of private physicians. In this way, the results of public health clinical work extend much farther than merely to that part of the public which the clinics themselves actually serve.

The work that is being done by the Department of Reconstruction of the United States Army, under the leadership of Col. Frank Billings, suggests possible extensions of public health activity since, in the broader and newer conception, public health work includes every activity that will increase the physical efficiency of the individual or community or which will restore the physically unfit to the highest point of health. To what extent this policy of reconstruction can be properly utilized in the future is open to question; but, in

the development of our future program, it is entitled to serious consideration. Certainly the work that has already been done by some health departments in the training and reeducation of persons crippled by poliomyelitis has been so gratifying and far-reaching as to justify the belief that reconstruction will one day be a part of public health promotion.

DEVELOPMENT OF HEALTH OFFICIALS FROM MEDICAL OFFICERS

It is obviously impossible to discuss at this time all the phases of preventive medicine influenced by the war, but one factor which will have a tremendous effect in altering the public mind in regard to health administration is the return to civil life of thousands of physicians who have received intensive training in sanitation and preventive medicine during their military service. It is to be expected that a large number of these physicians, having had their first experience in public service, will be reluctant to return to private practice, and there may be developed from them an unusually competent group of health officials; while those who return to private practice will exercise a new and salutary influence in their own communities.

POPULAR INTEREST IN PUBLIC SERVICE

In addition to this, there will be scattered throughout the nation approximately 4,000,000 young men who have had impressed on them in no uncertain terms the paramount importance of disease prevention and health promotion, and who have seen the advantage of yielding cheerfully to reasonable health regulations. These young men will naturally assume the leading part in their community affairs during the next generation and, with the guidance of public health departments of broader vision and larger resources, will materially influence the history of preventive medicine of the future.

The greatest changes in health development, however, will come out of the tremendous interest in public service created during the war and which found expression in the upbuilding of many large extragovernmental organizations engaged in various phases of patriotic and philanthropic work. With the war over, these organizations have been casting about for desirable fields for the expenditure of their energies and, in the majority of instances, they have settled on some phase of public health activity. This has created a situation which is disturbed and unique, full of possibilities for splendid progress and equally full of possibilities for confusion, overlapping, conflict and wastefulness.

This great popular interest will doubtless serve to stimulate the governmental health agencies to greater endeavor and will overcome official apathy and ultraconservatism. If these volunteer agencies can be properly coordinated under governmental guidance, they can be a tremendous influence for good. Unguided, however, the very multiplicity of organizations, the ease with which private funds are now obtainable for health purposes, and the lack of uniformity in views and methods will lead to wastage in money and effort and to the ultimate weakening and discredit of public health endeavor. The war has left us in a critical condition, full of possibilities for good and bad, in which sound judgment and firm policy by health authorities are imperatively needed.

ABSTRACT OF DISCUSSION

Dr. John P. Davin, New York: In those cities where the female prostitutes are arrested and sentenced to a term in some institution for treatment—what is done with the men?

Dr. C. C. Pierce, Washington, D. C.: The quarantine of a venereally affected person is not based on sex, but on the conditions which exist in each particular instance. If the man can be quarantined by the physician in charge of the case, and warning him of the precautionary measures to be taken, theoretically he is in quarantine, if he observes the directions given. If there are men who wilfully or through

ignorance continue to expose themselves and to make themselves a menace, they should be and are being detained. In one county in a southern state, about 325 venereally infected men have been detained for treatment until they reach a non-infectious stage. It depends on the scope of the state law. If the case is reported by number only, the physician so reporting the case assumes responsibility for that patient so conducting himself as not to continue to be a menace to his associates, but I wish to have it clearly understood by everyone that the quarantine of venereally infected persons is not being based on sex, but is being based on the conditions which exists. If there is no way of controlling the situation, except by putting patients in detention for treatment, that is the proper procedure to follow. The reason that more women are detained than men is because women usually have no other means of support than to continue to expose men to infection, whereas the men are situated differently and it is not always necessary to quarantine them.

DR. JOHN P. DAVIN, New York: I asked the question because in New York state they passed a law compelling the physical examination of every woman arrested, in the course of the propaganda, and the treatment of that disease. That law was pronounced unconstitutional, because it did not apply to men. That was remedied. Now, in the case of men arrested, are they examined for venereal diseases? How can you say that a man can be overlooked, when the woman is arrested as a prostitute? In regard to the state treatment of this disease, in my opinion, as conducted in New York, it is a wrong and foul thing. Coming down from the state convention in Syracuse, I found a placard in the men's apartment of the smoking car in which was used words which would not be used in the lowest and most vulgar journal when quacks were advertising, speaking of loose women and whores. Now, there are lots of young people who go into the men's apartment, who would not know what a whore or loose woman was, and I think that that propaganda carried out that way is something that I want to have an opportunity of protesting against. A million dollars have been appropriated by the government of the United States for the cure or treatment of venereal diseases, and part of that is expended. A campaign against venereal diseases should be carried on as most of our campaigns are carried on, as a promotion campaign. The medical profession has not done its duty in this matter. We did not do it because we did not understand it. We do now understand everything done. The biggest men in New York, when I was a young man, gave their attention to these people, just as they do to everybody else. The health officers are not in this respect giving any credit to the practice of medicine in their propaganda, any more than the life extension institute in New York, in conducting a campaign in the name of public health.

NEW JERSEY'S WORK IN MOSQUITO CONTROL

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President, Atlantic County Mosquito Extermination Commission
ATLANTIC CITY, N. J.

The "Jersey mosquito" seems to be known everywhere and has given our state an unenviable notoriety all around the world. As a matter of fact, the mosquito is no worse in New Jersey than in any other seaboard state having large areas of salt marsh land. In Connecticut, New York, and especially Long Island, Delaware, Maryland, Virginia and all the states bordering on the Atlantic seaboard, the same problem exists, and exists as acutely as it does in New Jersey; but the millions of visitors to the coast resorts of this state have been the means of our opprobrious advertisement in all corners of the globe.

Living in an era of intensive research and practical achievement, we cannot appreciate the passive attitude of accepting pests, such as the mosquito, and other health scourges without an attempt at relief when the methods of relief are practical and efficient. It is not realized that it often costs a community and the citizens of it personally much more to support a mosquito nuisance than to eliminate it.

As long as eighteen years ago, interest was started in New Jersey in the question of mosquito elimination. In 1901 an organization made up of a few public spirited citizens was formed in Orange, N. J. These men at that time had little information as to the life history, habits or varieties of mosquitoes, which is so necessary in effecting their elimination. Their work proved more or less discouraging because, in spite of money spent and work done, there were times wher great hordes of mosquitoes infested the community

About this time the late Dr. John B. Smith, the state entomologist, one of the greatest pioneers in this work, began to investigate the situation. He collected perhaps the most valuable fund of information known as to their life history, habits and varieties, and his published report will always be a superb classic and an unparalleled contribution to the knowledge of the subject. Dr. Smith created so much interest among his friends and was so successful in proving by his experiments that the elimination of this pest could be accomplished, that he finally succeeded in getting the legislature to pass an act appropriating $350,000 for the work. This was to be set aside as a fund largely for experiment, a certain amount determined by the law makers to be appropriated annually. He soon demonstrated that it was no idle dream, but the work progressed so slowly that the legislature in 1912 passed an act creating commissions in each county, the funds to be raised by the assessment of from 0.25 to 0.5 mill on each dollar of the tax budget of each county.

Commissions were then appointed in the various counties, the seaboard counties being the most active in the matter. These commissions then went actively to work to solve the problem by obtaining all the known data on the subject, employing expert engineers and practical men, and forming a state organization which meets annually to exchange views on the question. These county commissions are coordinated with the state experiment station and are under the direct supervision of the state entomologist, Dr. T. J. Headlee. The result is that the movement is organized all over the state. It is the most perfect organization, perhaps, of any large public movement in the state, and numbers several thousand enthusiasts in its membership.

"The work of New Jersey, which was the first state to take up this question," says Dr. L. O. Howard, the entomologist of the Smithsonian Institution, and per-

haps the world's greatest authority on mosquitoes, "is so far ahead of every other state and every other country as to stand practically alone." One of the early presidents of the New Jersey Mosquito Extermination Association said a few years ago: "Our work in New Jersey will probably be responsible for a country-wide movement against the mosquito." These words are coming true. The outbreak of the recent war and the necessity for the protection of the health of the soldiers in the camps has brought this matter to a speedier consideration by both the public and the authorities than would have been possible otherwise, although before the war the activities of New Jersey were being felt in many other progressive communities, notably in the malarial districts of certain southern sections. However, when the time came to speed up the protection of the camps from disease, it was to New Jersey and the New Jersey Mosquito Extermination Association that the government called for help. Several of the superintendents of the county commissions of New Jersey were selected to direct and supervise the work in the various cantonments, while the work of the Bergen County commission under the direction of their able chief inspector, Mr. J. B. Leslie, at Camp Merritt, the principal embarkation camp of the army, was a real contribution to the success of the war. The great shipyards at Hog Island and the work at League Island and Bristol were laid out under the direction and advice of New Jersey engineers and mosquito experts.

Camp Merritt, an embarkation camp situated in a malaria district, presented a situation of the utmost importance, since soldiers coming from all parts of the country might acquire infection. Among them also would be numbers of carriers of malaria brought from other states, especially the Southern states. As will be seen, the conditions would have been ripe for a continuous epidemic of malaria, which would have

been carried not only to our own troops abroad but to those of all the allies. As soon as the site was chosen for Camp Merritt in 1917, the Bergen County

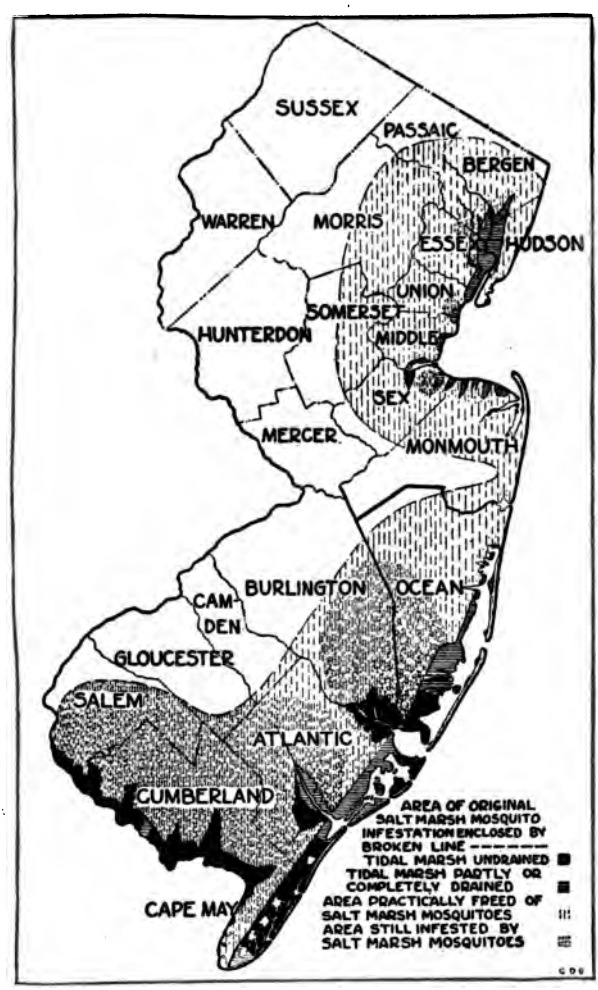

Fig. 1.—Flight of salt marsh mosquitoes inland from coast.

commission made a complete survey of the territory affected and an investigation of malarial conditions then existing. It was found that while the camp stood

on high ground it was almost completely surrounded by sluggish streams and overgrown swamps. *Anopheles* breeding was found along the edges of the slowly moving streams and ponds. The situation was pointed out to the commanding officer and the danger explained to him. He immediately saw the importance of it. The Public Health Service and the commission combined forces to push the work rapidly under the direction of the commission, the government supplying the labor. The work was pushed rapidly and watched carefully, and the total area controlled was about 15 square miles. The result was that during the summer of 1918, mosquitoes in and around the camp were reduced so far below the nuisance point as to be negligible; and although there were some recurrent cases of malaria among the troops coming from a distance, *there was not one case of malaria during the entire summer* which originated at Camp Merritt.

Malaria is the only mosquito-borne disease in New Jersey, and we find that in comparatively few places. There is almost none in south Jersey, but it has been troublesome at times in certain sections of the upper parts of the state. One of the most remarkable examples of what can be done, with comparatively little expense, occurred a few years ago at Princeton. The university students as well as the people of the village were seriously stricken with an outbreak of malaria. The low lying basins about Princeton were found on investigation to be prolific breeders of *Anopheles quadrimaculatus,* and there was much illness. The small sum of $10,000 was raised and active and systematic work done under the direction of the state director of mosquito extermination by the local authorities. In a year's time the number of cases of malaria dropped from 257 to eight. The following year there were none. The economic importance of this result and the health importance of the protec-

tion given to a community like this with its great university is almost unmeasureable. The time allotted for this paper does not permit the mention of many cases in detail. The fact that the United States government was enabled to send millions of soldiers through Camp Merritt, situated in a naturally malarial district, without one single case of malaria occurring there, and the startling result attained at Princeton furnish brilliant and instructive examples of what can be accomplished with thorough organization, anywhere.

WORK IN MOSQUITO CONTROL IN NEW JERSEY

County	Total Amount Expended on All Kinds of Antimosquito Work to Date	Area Protected in Sq. Miles in 1918	Population Protected in 1918	Salt Marsh	
				Total Acres	Acreage on on Which Breeding Has Been Eliminated
Atlantic	$139,503.90	50.0	60,000	49,998	37,636
Bergen	76,000.00	182.0	178,596	8,378	5,800
Burlington	.....	.....	.....	9,943	.....
Camden	.....	.....	.....	.....	.....
Cape May	30,000.00	10.0	6,000	53,638	20,480
Cumberland	.....	.....	.....	52,661	.....
Essex	406,845.90	126.0	665,000	4,500	4,500
Gloucester	.....	.....	.....	.....	.....
Hudson	177,060.42	42.5	670,467	11,468	7,000
Hunterdon	.....	.....	.....	.....	.....
Mercer	.....	.....	.....	.....	.....
Middlesex	31,510.96	311.9	135,000	8,199	4,500
Monmouth	26,619.00	125.0	58,000	3,378	3,278
Morris	2,000.00	Survey work only		.....	.....
Ocean	35,000.00	.....	20,000	40,000	27,000
Passaic	75,268.95	36.0	245,000	.....	.....
Salem	.....	.....	.....	31,780	.....
Somerset	.....	.....	.....	.....	.....
Sussex	.....	.....	.....	.....	.....
Union	182,000.00	104.0	150,000	4,413	4,000
Warren	.....	.....	.....	.....	.....
Totals	$1,181,804.13	987.4	2,188,063	278,365	114,394

Certainly the vision of the pioneers of this work in New Jersey and the tremendous fund of information that has been acquired and is on record deserve our greatest respect and admiration. These men should be proud of their handiwork, which has set the standard for communities in many other states. Those who are interested in mosquito extermination in any way will find scientific and practical discussions of nearly every phase of the subject in the annual reports

of the New Jersey Extermination Association for the past six years. These reports have become classics and are much sought after far and near.

All mosquito extermination must be based on the scientific knowledge of the different varieties of mosquitoes and the life history and habits of those to be dealt with in any given community. In nearly all inland places the problem is comparatively easy because it deals with what are known as local types of mosquitoes. Such types as *Anopheles* and *Stegomyia pipiens* never migrate farther than from 1 to 5 miles from the place where they are bred. Cleaning up the immediate district and organizing a good place for follow-up inspection, therefore, will quickly rid any given community of the pest, as in the case of Princeton.

Contrast now, with this, the coastal states with large areas of salt marsh meadow land breeding *Aedes sollicitans,* which has a flight under proper conditions of wind and weather of at least 40 miles. The coast counties also have the same problem of local mosquitoes as inland places, so that the authorities on the one hand must look after all local types of mosquitoes, and on the other must rid the salt marshes within a radius of 40 miles from any given point by a systematic drainage system, in order to have relief.

Of the forty different species of mosquitoes found in New Jersey, practically the only ones of economic importance are the local types known as *Stegomyia pipiens* or the house mosquito, and the malarial *Anopheles* group. The other local types are negligible. The real problem in New Jersey is to rid the state of *Aedes sollicitans,* which at times makes life miserable for nearly half of the population of the state by reason of their long flight from the seacoast, inland. Hotels will fail, summer resorts die and agricultural and industrial interests lag if unfortunate enough to be situated in districts badly infested by hungry hordes of mosquitoes. It is for this reason that New Jersey

Fig. 2.—Typical marsh pool in meadows near Atlantic City.

Fig. 3.—Machine-cut ditch 10 inches wide by 30 inches deep, such as is used in all antimosquito work in Atlantic City.

Fig. 4.—Old style wooden drain holding water at all times.

Fig. 5.—Boats open to the weather will soon raise a crop of insects.

Fig. 6.—One of the beauty spots of Atlantic City. Water under such rubbish is hard to oil for mosquito elimination.

Fig. 7.—A typical back yard on the north side. Some of these tubs were used for washing clothes, others for raising mosquitoes.

has waked up to the vital importance of freeing the whole state from this menace to health and progress, and is setting the pace for other states. This community and many others in the state have been freed entirely from local and disease-bearing species of mosquitoes, but much work still remains to be done before the vast areas of marsh land will be clear.

About 16,000,000 feet of standard 10 by 30 inch ditching have already been cut on the salt marshes in the state; about one third of this is in the county of Atlantic, representing about 1,100 miles of ditching or one third of the distance from here to Paris. There are in the state 296,000 acres of salt marsh. There still remains to be treated about 150,000 acres, so that it may be seen that the work is about half completed. During the next five years, according to the plans now laid, this whole area will be drained and New Jersey, the home of the mosquito, can say to the world that it has no mosquitoes. Can any other state say as much by that time, especially the coast states having the same difficulties as New Jersey?

After all the work is done, the maintenance of it is of supreme importance. It is estimated from the experience already gathered that the maintenance cost per year per acre will average 35 cents. The area which has up to date enjoyed protection from the mosquito pest is 937 square miles. The population protected by this work is 2,188,063 people of the state. The per capita cost of such protection is about 15 cents.

ORGANIZATION OF A COUNTY UNIT

It might be of interest to describe the organization of a county unit, such as exists in this county and many others of the state. A commission composed of six men is invested with the responsibility of the work. A superintendent or chief inspector is the active head who, with his assistant, has full charge of the office, the various gangs of salt marsh workers and the local

inspectors of the fresh water work. It is necessary for the chief inspector to be a thorough expert mosquito man and a practical executive. The work on the marshes is done by ditching machines which cut ditches 10 by 30 inches very rapidly through the marsh. Five hundred feet can be cut often in fifteen minutes, and as much as from 1,000 to 5,000 feet in a day's time. Each machine gang is under a foreman, and consists of five men. The number of feet that can be cut per day is limited only by the number of machines and machine gangs that can be employed, and that is a question of money. There are in this county, alone, about 50,000 acres of marsh land, and of this 61 per cent., or about 37,000 acres, have been drained, leaving about 13,000 acres yet to be done. These ditches, draining into open thoroughfares and bays, allow the tides to come and go through the ditches, which are placed about 100 feet apart. As the tide recedes, the meadow land between the ditches is dried out by seepage, making mosquito breeding impossible; at the same time it allows millions of the small killifish to run up the ditches and into the pools. These fish are our most efficient allies, because they feed on the mosquito larvae. During severe flights of mosquitoes, when the undrained meadows were producing billions of mosquitoes, our patrol service has found practically no breeding on the drained and ditched meadow. That is the best test of its efficiency.

Constant patrol is given this vast stretch of marsh, and whenever breeding is found it is charted on a map in the central office so that everything the mosquito does is known at headquarters. Whenever a ditch is ineffective or clogged, all points in regard to the development of a brood of mosquitoes are charted daily, so that it can be told several days beforehand just what is going to happen, and according to the direction of the winds just what communities are going to be troubled on a certain date with an infestation, and how severe it will be.

This refers to the coast and the marshes; but the large part of this country is not on the coast, and the inland dweller is not interested in it. His problem is the fresh water or local types of mosquitoes. It is much simpler and much easier to produce almost immediate results with these varieties, because of their short migration.

The organization of this work is under the same executive head as the marsh work. Each city in this county is divided into districts. Each district is given to a local inspector whose duty it is to cover every property in his district every ten days in the mosquito season. The inspection of each property made for the day is recorded on a separate card and checked up at the office at the close of the day and filed. If he has found breeding on any property, this report must be on a pink card. It is his duty to eliminate such breeding as may be found in a rain barrel or a tin can, or other receptacle, and note just what and where it was. If it is stagnant water under a house or in some other locality, it is reported, and the ditching squad or the oiling squad follows it up the next day. If the water can be drained away, it is done. If not, it must be oiled. Each pink card report filed in a separate case must be followed up in not less than ten days and checked up. When oiling is necessary, the oiling squad must be on hand regularly every ten days to oil the surface of the water; but in reality in this community oiling is a small part of the work. As a matter of fact, after the first complete inspection at the beginning of the summer there is not much difficulty with local types of mosquitoes, except in the new conditions that may arise from week to week; and as soon as these are discovered, they are promptly eliminated. A large wall map of the city shows every spot in the city on which mosquito breeding has been eliminated for the year, and is valuable as a clue to any trouble that may arise in the future years.

By systematic organization of this sort and careful follow up work, knowing the kind of mosquito to be dealt with and his life habits and proclivities, any community with a comparatively small expenditure may rid itself of this terrible pest and enemy of health. In many communities there are engineering problems of tide gates, dikes and other methods of handling drainage besides ditching. All these may be overcome by intelligent cooperation and intensive study, and there ought to come a time when every community infested with mosquitoes will be as much under the ban as if it had the worst sanitary conditions. As a matter of fact, these two things, mosquitoes and bad sanitation, usually go hand in hand; where the one is, the other will be found.

1704 Pacific Avenue.

ABSTRACT OF DISCUSSION

DR. JUAN GUITERAS, Havana, Cuba: I would like to ask here whether any responsibility is attached to the house owners in connection with domestic mosquitoes; whether the house owner is considered responsible for mosquitoes bred in water barrels and other water containers; whether any system of fines is established and imposed on such persons.

DR. JOHN E. FERRELL, New York: I think all who have been interested in the subject of malaria control, will receive encouragement from the paper which has been read today, indicating the feasibility of mosquito control in the very difficult areas of New Jersey. I have no doubt that those present know of the malarial control measures which have safeguarded the troops at Camp Merritt, and that they have also been carried on in all the camps throughout the country, and it is one of the greatest achievements of governmental agencies, state, federal and local, which have been entrusted with this task. You can start at Camp Merritt and go south throughout the districts where the anopheles mosquito is a menace and find that through the governmental agencies malaria has been controlled. It is important, it seems to me, having this demonstration before us, to suggest that the time has now arrived to maintain what has been obtained throughout these areas, particularly in the South, and to accept the suggestions of Dr. Darnall, and develop whatever agencies may be necessary in extending this work which has made one of the best and most successful health demonstrations we have had in connection with war work.

DR. J. D. MCLEAN, Philadelphia: Pennsylvania is following on the line of New Jersey and being taught by this state in the control of the mosquito. Pennsylvania's state board of health expended last year $99,000 for the elimination of disease breeding spots. The commissioner of health of the state feels assured that in the future his hands will be much stronger than they have been in the past, and that the mosquito breeding spots in Pennsylvania will be entirely wiped out in a very short time. The work is being continued this year and we are spending from sixty to sixty-five thousand dollars on that work. We have several just as bad breeding spots as they have in New Jersey. They are along the Delaware River, and not only in the Hog Island district. They are still farther north.

DR. JOHN P. DAVIN, New York: I am very proud as a member of this section, to hear what has been done at Camp Merritt, because I happen to have a rather intimate association with one of the gentlemen connected with that work, Edward Davin of the U. S. Army, my son.

DR. ARTHUR T. MCCORMACK, Bowling Green, Ky.: I want to call the attention of the section to two practical propositions. In the first place, last year one of our sanitary inspectors in Panama designed a form of sectional concrete ditch bottoms of varying diameters, 30 inches long and about 4 inches thick, of reinforced cement, with a male and female end, so that the segments will fit one into the other, and buttering these segments with green cement, it makes a tight ditch bottom. You can lay it as you lay a pavement, very readily and very economically, and it gets rid of the problem of ditch maintenance, which is one of the greatest expenses in malarial work, because it involves a greater capital expense. I was in Panama about four and a half months before I saw any mosquitoes in the sanitated area, and then I found two in an unused bathroom in my house. My wife telephoned to the authorities and in about fifteen minutes an automobile truck drew up with a sanitary inspector and five negro laborers from the health department in it. They went through various rooms, and after a short time located the offenders. The sanitary inspector went in with his little test tubes and he caught the mosquitoes. He examined them. It happened to be a variety I knew very little about personally. Apparently there was a hole in the screen, and so he called up the health department. They telephoned down to the proper section, and immediately a truck came with four more men, and they very carefully went over the screening, yard by yard, and found two holes large enough for these mosquitoes to come in. The screening was repaired, and we had no more trouble. In the meantime, the sanitary inspector of the health office came up with a blueprint of the entire area, because this variety of mosquito

had a flight of about a mile, and on the blueprint was shown every place where mosquitoes bred. Every place was examined with a view to finding where these mosquitoes had bred. On the second day they found that just about a mile from the house was a wet spot where there had been some clogging of a drain and that little wet water stream, to use a common expression, was responsible. That drain was cleared out, and then the inspectors went to every house within half a mile and they found in two other houses a few mosquitoes. It is interesting to know how thoroughly such work can be done, and to know that that is the standard toward which we are aiming.

DR. WILLIAM E. DARNALL, Atlantic City, N. J.: It was quite impossible for me to enter into all the different phases of the work. The time allotted to my paper was too short to go into details. In reply to Dr. Guiteras' question as to fines, we have no such system, for the reason that in the minds of the layman, the whole problem is yet considered more or less experimental. Five years ago many people thought it was a joke. Nobody believed that anything could be done to free a community of mosquitoes, and therefore, to put fines on people with such an uninformed state of public mind would result in the work becoming unpopular to such an extent it would be dispensed with. One of the main duties of all local inspectors is to instruct people. For instance, if mosquitoes are found in your house or on your premises and the inspectors find their source in rain barrels or other receptacles, he demonstrates to the house holder the egg boats, larvae or pupae; explains to them how they develop into mosquitoes; empties these receptacles in order to eliminate the source of breeding, and instructs the people that it is their duty to eliminate the mosquito, and to keep stagnant water out of every receptacle and they will be free from mosquitoes. You would be surprised to find out how the ordinary, so-called ignorant people take an interest in it and go around and tell the neighbors about it, and so the propaganda spreads. That is the way we have accomplished educational results, along, of course, with a certain amount of newspaper publicity. The result is that the whole community is interested.

THE DEMAND FOR COMMUNITY NURSING SERVICE DURING THE RECONSTRUCTION PERIOD

B. R. WAKEMAN, M.D.
Sanitary Supervisor, State Department of Health
HORNELL, N. Y.

In contrast to normal times the war period has had its effect on the supply of physicians and especially nurses, not only in the cities but in villages and rural districts. Many a small community was badly handicapped by having no physician available, and nursing service for the severely ill could not be secured. The pandemic of influenza made this condition very acute. Many persons died from the want of proper care. Death rates for influenza were lower in localities having adequate nursing service. This situation has created a demand for some sort of nursing service, especially in villages and rural sections.

Community nursing should not be confused with what is generally known as public health nursing. The so-called public health nurse is one employed by a visiting nursing association, combining the activities of the social service worker with that of a district or visiting nurse. Except in the larger cities, her work is directed by a committee of lay women from the visiting nursing association.

To quote from a circular issued by the National Organization for Public Health Nursing: "This committee should be composed of women who will meet monthly or oftener. It should go over with the nurse, her reports of work, of family needs and neighborhood conditions, making suitable recommendations to the

board of directors." At times she may do some infant welfare and prenatal nursing, visit tuberculosis patients and the schools. This sort of service is remedial in contrast to preventive nursing.

Our modern conception of a community nurse is one employed by one or more rural municipalities to do constructive public health work, mostly educational, with a limited amount of bedside nursing. The community nurse is under the supervision of the health authorities, both local and state. She is the field agent of the health department.

The ideal community nurse should be equipped to carry on all lines of public health work. She should be the health officer's assistant and he should advise and direct her as to her specific duties. She should report daily to the health officer, assist him in the quarantine and supervision of communicable diseases. She should be trained to investigate the source of communicable disease, and to take throat cultures for diagnosis and release of diphtheria cases. She should be trained as a sanitary inspector to investigate nuisances and complaints. The systematic sending of milk samples to the laboratory could well be left to the nurse.

A community nurse should not only be equipped to do school nursing, under the direction of the medical inspector of schools, but she should also be able to give talks on hygiene to the schoolchildren, and to advise with the teachers as to methods for the control of communicable diseases in the schools. Her school nursing will take her into the homes of the parents where she can teach the principles of home sanitation and interest them in the great public health problems of the day.

Child welfare work should appeal strongly to the community nurse, in view of the opportunities for prenatal instructions to the expectant mother, classes for nursing mothers, instructions on the diet suitable for little children, and clinics for the examination of children of the preschool age.

The nurse should know something about the principles of prevention and relief of tuberculosis. In cooperation with the county tuberculosis nurse, she should organize an occasional tuberculosis clinic in her district. She should be instructed how to make a tuberculosis survey as well as a survey of postinfluenza cases. This will give the nurse an opportunity to assist, cooperate with and stimulate the interest of the family physician in public health matters generally.

The community nurse should have some training in social service in order to adequately meet the needs of her locality. In the smaller communities there is no organized social service. As a social worker she can cooperate and advise with the poor master and with church societies in the matter of furnishing relief. The nurse, many times, can secure employment of a patient on recovery or obtain proper work for other members of the family and thereby do her bit for the abolition of poverty. No better agency is available than the community nurse for making investigations for the war department.

Public health education should be one of the activities of the community nurse. Many women's organizations, parent-teachers clubs, the grange and farmers' institutes, will always welcome the nurse, on their programs. Classes in home nursing should be conducted by the nurse. A corps of trained assistants should be organized to assist the nurse in times of epidemics or disasters. First-aid instructions should be given to various groups, both men and women.

From the foregoing schedule of activities, it is easily seen that the successful community nurse should be a specialist in many lines of work besides that of district nursing. The training and supervision of community nurses can best be carried on by the staff of the state health department, being made up of experts covering these various lines of work. This service to be a success must be in close association with the work of the department. The New York State Health Depart-

ment, anticipating this state-wide demand for community nursing, has tentatively divided up each county into community nursing districts, having due regard for county borders and including adjoining towns and villages. In the formation of these units, consideration was given to the needs of the population, accessibility, transportation facilities, and the ultimate taking over of the work by the municipalities concerned. The first municipality in the state to ask for the installation of a community nursing service was the consolidated health district of Alfred, Allegany County, N. Y., a district having approximately 2,000 population, including about 450 students at Alfred University, one high school, one grammar school and seven district schools. Twelve hundred dollars was appropriated by the board of health for the nurse's salary, and $250 for office equipment and expenses. This service was inaugurated Jan. 1, 1919.

The situation in Alfred is somewhat different from that in most communities of this size, in that there is no active physician in practice in the confines of Alfred Township. The nearest physician available is 7 miles away in an adjoining township. In this community of 2,000 people, including the students of Alfred University, a nurse must necessarily make some calls as an agent of the physician, although she is very careful not to supplant him in any way. Whenever she makes an emergency call she is required to get in touch with some physician before she leaves the case, and must follow his advice and directions. She will answer maternity calls in the capacity of midwife only when explicitly directed to do so by an attending physician.

The attached schedule of activities of the Alfred Nursing Service is only a catalogue of things which a nurse of this sort may properly do. It is not a daily, weekly, monthly or even yearly schedule. The nurse is here to assist the health officer, to care for the sick and be prepared to handle emergencies whenever they

arise. When she is not caring for the sick, she may properly carry on some educational work. Some days she may have only one or two calls to make. In so far as the sick calls are concerned this is not a free service. Persons who are able are expected to pay for the nurse's calls. However, provision is made for the care of persons who are not able to pay.

SCHEDULE OF ACTIVITIES OF A COMMUNITY NURSE

I. *Public Health Work:*

1. Daily report to health officer.
2. Assistance in quarantine work and supervision of communicable diseases.
3. Investigation of sources of all communicable diseases.
4. Taking of all throat cultures for the release of diphtheria cases and carriers.
5. Investigation of nuisances and complaints.
6. The sending of monthly samples of milk to county laboratory for bacterial analysis.

II. *Education in Public Health:*

A. Under the direct personal supervision of the health officer.

1. Child welfare work; conference with young mothers.
2. Little Mothers' League in grammar school and district schools.
3. Talks on personal hygiene in all schools.
4. Class work; principles of bed-side nursing; school of domestic science, Alfred University.
5. Conference with all teachers and professors and instructors for cooperation in the control of diseases among schoolchildren and college students.
6. Instructions in first aid.

B. Under direction of educational authorities.

1. Organization of Modern Health Crusaders in the schools.
2. District school nursing.

C. Addresses before Women's Clubs, the Grange and other organizations.

III. *District Nursing:*

1. Answering of all emergency calls when physicians are not available.
2. Answering of all night calls under direction of physician.

3. Giving first aid; taking of temperature, pulse, giving of enemas, baths, etc.; telephoning physician in regard to conditions found and following his directions until he can get to patient.
4. Home-to-home bed-side nursing.
5. Assisting in all confinement cases for which no nurse is engaged.
6. Supervision of college infirmary and its equipment.
7. First-aid surgical dressings; subsequent dressings under direction of physicians.

IV. *Office Work:*

1. Office hours: 1—2 p. m.
2. Daily record book of activities.
3. Community nursing calls.
4. Minimum charge for visit, $1.00 per hour or any portion of an hour; after 6 p. m. $2.00.
5. Sending of monthly bills.
6. Opening of account in bank: Community Nursing Fund.
7. Expense account, supplies, etc.

V. *Reports:*

1. Monthly report to consolidated board of health.
2. Monthly report to health officer on communicable diseases.
3. Financial reports.

VI. *Supporting Activities:*

1. Board of health appropriation for salary, $1,200.
2. Community Club contributions for Community Nurse Fund.
3. Alfred University contributions to Community Nurse Fund.
4. School Trustees' contributions to Community Nurse Fund.
5. Alfred Grange contributions to Community Nurse Fund.
6. Firemen contributions to Community Nurse Fund.
7. Lodge contributions to Community Nurse Fund.
8. Church contributions to Community Nurse Fund.
9. Community nurse's day (tag day?) to Community Nurse Fund.

VII. *Equipment:*

A. Office furniture and equipment.

1. Desk.
2. Card filing system.
3. Telephone.
4. Record books.
5. Cards.
6. Printed bills.
7. Stationery.
8. Stamps, etc.

B. Supplies.

Emergency surgical dressings.

Tuberculosis supplies; paper napkins, paper towels; individual drinking cups.

C. Drugs.

All drugs and chemicals to be furnished on nurse's or doctor's order and filled by Ellis Drug Store. If patient is able to pay, druggist to make charge to patient. If unable to pay, druggist to make charge to Community Nurse Fund.

D. Nurse's bag and equipment.

Bag and equipment similar to that used at the Henry Street Settlement, New York.

E. Drugs.

Squibb's soda.
Rochelle salts.
Castor oil.
Petrolatum.
Zinc oxid ointment.
Balm analgesic.
Can of mustard.
Syrup of ipecac.

VIII. *Finances:*

1. All contributions, donations, fees, etc., will be paid over to the community nurse, who will receipt for them and promptly deposit them in the bank to the credit of the Community Nurse Fund.
2. An itemized expense account with proper vouchers attached will be rendered by the nurse to the consolidated board of health for audit at the regular monthly meeting, the first Monday in each month.
3. All checks drawn against the Community Nurse Fund must be signed by the nurse and countersigned by the president of the board of health.

4. The salary of the nurse will be paid the first day of each month by check drawn by the president of the consolidated board of health against the salary appropriation fund of the board of health.

IX. *Transportation:*

1. Outside of village transportation is to be furnished by the patients, if able to pay; if not able to pay, to be paid out of the fund on monthly audit.
2. District school visits to be paid for by school trustees.
3. Quarantine expenses and investigation of communicable diseases to be paid for by health officer or board of health.
4. Transportation and expenses to annual conference to be paid from Community Nurse Fund.

X. *Vacation:*

The community nurse to have three weeks' vacation with pay and one week sickness allowance during the year.

XI. *Educational Equipment (Coeducational):*

1. District schools (7).
2. Grammar school (1).
3. High school (1).
4. Alfred University.
   (*a*) College.
   (*b*) Divinity School.
   (*c*) Students' Army Training School.
   (*d*) N. Y. State School of Agriculture.
   (*e*) N. Y. State School of Ceramics.
   (*f*) Summer School.
5. Churches (5).
6. Newspaper—The Alfred Sun.
7. College publications.

XII. *Suggestions:*

1. It is suggested that a community nursing service advisory committee be formed, one member of which should be selected by each organization, lodge or association contributing to the Community Nurse Fund.

2. It is suggested that this committee or its chairman be invited to meet with the consolidated board of health from time to time to assist in formulating rules and regulations for the Alfred Community Nursing Service, to suggest means for raising funds and to make suggestions for perfecting this work and making it more and more efficient.

3. It is suggested that one member of the board of health be designated, with whom the nurse can consult from time to time as to the proper charge to be made in certain individual cases, or whether or not charge should be made.

4. For the first month or so, until the service becomes popular, it is suggested that no charge be made for nursing calls. Any individual contributions to the fund are, however, not to be refused.

5. It is suggested that one of the second-floor front rooms in the Rosebush Block be rented for the community nurse's office, and fitted with telephone connections.

6. It is sugggested that arrangements be made with the drug store to receive calls for nursing service at times when the nurse is not in her office.

7. It is suggested that a proper sign be placed on the windows and doors of the nurse's office, stating the office hours.

8. It is suggested that the community nurse be sent to the annual conference of New York state public health nurses.

9. It is suggested that the board of health call a conference to be held early in January, 1919, for the purpose of explaining more fully the extent and limitations of this service and that the following persons be invited to be present:

1. President of the university.
2. President of the Community Club.
3. Pastor of the church.
4. Professor Binns (Episcopal chapel).
5. Druggist.
6. Banker.
7. Representative of firemen.
8. Representative of I. O. O. F.
9. Representative of the Masons.
10. Principal of Alfred Schools.
11. District school superintendent.
12. Head of domestic science department.
13. Head of Alfred Grange.
14. Community nurse.
15. Sanitary supervisor.

Since the installation of the Alfred Community Nursing Service, many municipalities have asked for a similar service. We were unable to meet this demand owing to the lack of graduate nurses trained in public health nursing. The nursing service of the Atlantic division of the American Red Cross had been appealed

to but could not furnish qualified nurses. The most insistent demand came from Monroe county, comprising fifteen community nursing districts outside of the City of Rochester. Many graduate nurses in and about Rochester expressed their willingness to take up public health nursing provided they could have a short course of preliminary study to enable them to grasp some of the fundamental principles of public health nursing. The state department met this situation by organizing a short intensive postgraduate study course, with lectures and field work at the University of Rochester; the Rochester Tuberculosis Association and the Rochester bureau of health cooperating.

Nurses registering for this course were not accepted until I had had a personal interview with them. A nurse, in order to be a success in public health work, other things being equal, must have an attractive personality. She should not be too young, and preferably she should have two or three years' experience in private nursing. Certain fundamentals such as tact, perseverance, enthusiasm, and professional ethics must be thoroughly drilled into them, before the work is taken up; otherwise the nurse will develop some opposition and will not be able to secure the cooperation desired. This is particularly true in her relations with the health officers and the practicing physicians in her district.

The following lectures and demonstrations were offered to the nurses during the month of April:

PROGRAM

Wednesday, April 2, 1919.

Room 32, Eastman Building, University of Rochester.

2 p. m. Introduction of the Course,
Dr. B. R. Wakeman, Sanitary Supervisor, State Health Department.

Address,
Dr. Wm. T. Hoeing, Dean, University of Rochester.

Address,
Mr. B. R. Richards, Assistant to Commissioner, State Department of Health.

Address,
Isaac Adler, President Rochester Tuberculosis Association.

Thursday, April 3.

9 a. m. Public Health Law and Sanitary Code,
Dr. B. R. Wakeman.

11 a. m. Community Nurse as a Social Worker,
Frank E. Wing, General Secretary, Social Welfare League of Rochester.

2 p. m. Communicable Diseases,
Dr. George W. Goler, Health Officer of Rochester.

4 p. m. Red Cross and Public Health Nursing,
Miss Anna Ewing, New York, Director of Nursing, Atlantic Division, American Red Cross.

Friday, April 4.

10 a. m. Bacteriology Demonstration,
Prof. Charles Wright Dodge, University of Rochester, given at Health Bureau.

2 p. m. Investigation of Contacts and Carriers,
Dr. H. F. Senftner, Epidemiologist, State Department of Health.

Saturday, April 5.

9 a. m. Epidemiological Investigations,
Dr. H. F. Senftener.

2 p. m. Visit to Municipal Hospital (Communicable Diseases).

Monday, April 7.

9 a. m. Venereal Diseases,
Dr. Joseph S. Lawrence, Chief, Bureau of Venereal Diseases, State Department of Health.
Dr. Joseph Roby, Deputy Health Officer, Rochester.

2 p. m. Venereal Clinics at Health Bureau.

7 p. m. Venereal Clinics at Health Bureau.

Tuesday, April 8.

9 a. m. Tuberculosis Nursing,
Dr. John J. Lloyd, Medical Superintendent, Monroe County Tuberculosis Sanatorium.

10 a. m. Tuberculosis Law,
Dr. Wakeman, Sanitary Supervisor, State Health Department.

1:30 p. m. Tuberculosis Dispensary.

Wednesday, April 9.

9 a. m. Tuberculosis Surveys,
Miss M. S. Kuhlman, State Supervising Tuberculosis Nurse, State Department of Health.

2 p. m. Tuberculosis Field Work,
Miss Kuhlman.

Thursday, April 10.

9 a. m. Tuberculosis Records and Reports,
Miss M. S. Kuhlman.

10 a. m. Publicity Methods and Health Education Work,
Mrs. Ethel M. Hendriksen, Executive Secretary, Rochester Tuberculosis Association.

1 p. m. Tuberculosis Field Work,
Directed by Mrs. Grace F. Sherrill, Supervising Tuberculosis Nurse, Tuberculosis Division, Health Bureau.

Friday, April 11.

9 a. m. Field Day, Monroe County Tuberculosis Sanatorium, Institutional Methods,
Dr. John J. Lloyd, Medical Superintendent.
Luncheon served at Sanatorium.

4 p. m. General Hospital.

Saturday, April 12.

9 a. m. Child Welfare,
Dr. Henry L. K. Shaw, Director, Division Child Hygiene, State Health Department.
Children's Aid Work,
Mr. Richard S. Redfern, Superintendent, Rochester S. R. C. C.

Monday, April 14.

9 a. m. Clean Milk and Safe Milk,
Dr. Goler, Health Officer of Rochester.

10:30 a. m. Visits to Pasteurizing Plant.

1 p. m. Visits to Dairy Farms of three kinds, Excellent, Good and Bad,
Milk and dairy inspections under direction of Mr. Emmett Gauhn, Chief Sanitary Inspector, Rochester Health Bureau.

Tuesday, April 15.

9 a. m. Modern Health Crusader Work,
Mrs. Ethel M. Hendriksen.

10 a. m. Field Work with School Nurses, Schools Nos. 14 and 20,
Under direction of Mrs. Lindsay Russ.

2:30 p. m. No. 18 School.

Wednesday, April 16.

9 a. m. to 4 p. m. Field Day at Open Air School,
Speakers: Mr. Andrew Johnson, State Organizer of Open Air Schools, New York City; Miss Katherine E. Fichtner, Principal; Miss Edith A. Scott; Dr. Joseph Roby and Herman J. Norton.

8 p. m. Birth Registration and Supervising Midwives,
Miss Mary Muldowney, Supervising Nurse, State Department of Health.

Thursday, April 17.

9 a. m. Piccadilly Theater, Health Campaigns for Rural Districts,
Mr. Gilbert M. Tucker, Jr., Supervisor of Exhibits, State Department of Health (Moving Pictures on Public Health Topics).

2 p. m. Methods of Teaching Home Nursing,
Mrs. Katherine Whittemore, Supervising Nurse, State Department of Health.

4 p. m. Municipal Control of Smallpox,
Dr. F. W. Sears, Sanitary Supervisor, State Department of Health.

Friday, April 18.

9 a. m. Work of the Home Bureau in Monroe County,
Miss Frances Grimes, Home Bureau.

10 a. m. Food Values; Experiments Now Under Way at University,
Prof. M. H. Givens, University of Rochester.

Saturday, April 19

9 a. m. Visit to Industry (New York State Agricultural and Industrial School).

2 p. m. State Institutions,
Mr. Geo. A. Hastings, Executive Secretary, Committee on Mental Hygiene.

5 p. m. Care of the Dependent Child,
Mrs. H. Ida Curry, State Charities Aid Association.

Monday, April 21.

9 a. m. Rural School Demonstration,
Miss Hazel Irene Stewart, Steuben County Nurse, Bath, N. Y.

2 p. m. Catholic Religious Observances,
Rev. A. M. O'Neil.

2:30 p. m. Catholic Charitable Agencies,
Miss Kathleen D'Oiler.

3 p. m. Jewish Charitable Agencies,
Rabbi Horace J. Wolf.

3:30 p. m. Other Welfare Agencies, Public and Private in Rochester and Monroe County,
Miss Alberta Smith.

Tuesday, April 22.

9 a. m. Rochester Dental Dispensary, with luncheon at dispensary,

Program directed by Dr. Harvey J. Burkhardt.
Speakers: Dr. Burkhardt, Dr. Masendont and Miss White.

2:30 p. m. County Home Service Work of American Red Cross, Mrs. VanWie.

3 p. m. Social Service,
Dr. William Kirk, University of Rochester.

5 p. m. Preparation for Survey,
Dr. Wakeman.

Wednesday and Thursday, April 23 and 24.

9 a. m. to 4 p. m. Field Work, Political, Educational, Charitable, Social and Sanitary Survey of Smaller Rural Communities: Fairport, Webster, Spencerport, Scottsville, Pittsford and Brockport.

Friday and Saturday, April 25 and 26.

9 a. m. to 4 p. m. Field Work. Make a Survey of Children of Preschool Age in Village of Honeoye Falls. Have children weighed and measured.

Monday, April 28.

9 a. m. to 12 noon Approved Methods of Raising Funds. Program for Community Betterment.
Mrs. Ethel M. Hendriksen.

2 p. m. Recreation,
Miss Fishbeck.

Tuesday, April 29.

9 a. m. Final Examination,
Dr. Wakeman.

2 p. m. Polio Clinic,
Dr. LeRoy W. Hubbard, Orthopedic Surgeon, State Department of Health, assisted by Miss Quackenbush, Miss Rebstock, Miss Maloney, Polio nurses.

Wednesday, April 30.

11 a. m. Assignments to Districts.

12:30 m. Luncheon, Rochester Club.
Cooperation of Community Nurses with State Department of Health,
Dr. John A. Smith, Secretary of Department and Director of Nurses, State Department of Health.
Experiences of a Red Cross Nurse Abroad,

Miss Mary Laird, R. N., Rochester, N. Y.

On the completion of the course I placed practically all of the nurses in good positions, paying from $100.00 to $120.00 per month. In Monroe county the com-

munity nurses are working under the direction of an expert county supervising nurse. They are to be called in monthly for a conference with me. By this method I hope to make qualified public health nurses whom I can recommend for any position outside my district. I consider this month of lectures merely as an introduction to a six months' course under my personal direction, the last five months of which are made up of field work and conferences.

GENERAL HEALTH ACTIVITIES AND THEIR EFFECT ON TUBERCULOSIS MORTALITY

GEORGE THOMAS PALMER, M.D.
SPRINGFIELD, ILL.

In preventive medicine, it is generally assumed that the discovery of the causal organism and the means of transmission of a communicable disease will be followed by a definite reduction in its prevalence and mortality, and that this reduction is greatly increased by an intensive campaign of popular education. This has been our experience with typhoid fever, yellow fever, malaria, diphtheria and other diseases, and it was the experience contemplated in dealing with tuberculosis. It has now been almost forty years since the identification of the tubercle bacillus, and almost thirty years since the first organization was created to combat the disease by means of popular education. For fifteen years that educational campaign has been intensified by the National Tuberculosis Association, which, with its affiliated societies, has become the largest and strongest extragovernmental health agency the nation has ever known. It is interesting at this time to consider what progress has been made in dealing with this most widespread of diseases and to attempt to determine, if possible, the means by which the very striking results have been accomplished.

Experience has taught us that tuberculosis cannot be measured by the standards which apply to other contagious and infectious diseases. The attempts to develop preventive and curative vaccines or serums from the tubercle bacillus, such as we have produced in diphtheria and typhoid fever, have resulted in failure and disappointment. We have been forced to conclude that active tuberculous disease is not the result of a simple

infection. Likewise, our efforts to control the disease by the restriction of public spitting, based on the fact that bacilli are commonly found in the sputum, have not given results which inspire any high degree of confidence. Tuberculosis has resisted our efforts to deal with it as a simple question of infection or contagion.

The relationship between infection and disease has been shown to be very remote. It is accepted that acute tuberculosis is not caused by any single organism acting alone. Dormant infection is so general that perhaps 80 per cent. of adults may be classified as "tuberculosis carriers." The development of the disease, after infection, is dependent on some factor or factors which reduce individual resistance, and these factors are to be found in every phase of the social life of the individual or of the community. Obviously, in the light of our present knowledge, victory over tuberculosis cannot be expected to result from warfare against the tubercle bacillus, however thoroughly that warfare may be conducted. Our present belief must be that success will come through our learning how to live with the tubercle bacillus rather than in striving to avoid initial infection.

I do not mean to convey the idea that we should abandon in any way the means we are now employing to prevent the spread of infection. Open cases should be isolated, coughing and spitting should be restricted, and increased pains should be taken to protect children from contact. I am profoundly impressed that by these means alone we shall not master the disease, and I am frankly doubtful if such means have been the important factors in achieving the success which has crowned the efforts of tuberculosis agencies in the past.

As to the success in the past, there can be no doubt. During the twenty years following the establishment of the first volunteer tuberculosis association, tuberculosis mortality decreased from 238 per hundred thousand of population to 166 per hundred thousand, or a

decrease of 30.25 per cent., while a comparison of five-year periods during the past fifteen years shows a tuberculosis decrease of 22.2 per cent.—a more gratifying showing than that of any other communicable disease for which science had not provided a specific preventive, with the single exception of scarlet fever. With such a showing, the battle against the germ, which has characterized our avowed program in the past, seems to have fully justified itself.

But, a further observation of statistics causes us to become somewhat skeptical. During the twenty years from 1872 to 1891, the twenty years preceding the nation-wide educational movement and including ten years preceding the discovery of the tubercle bacillus, the mortality from tuberculosis decreased from 339 per hundred thousand of population to 245 per hundred thousand, or a decrease of about 27.5 per cent. In fact, Hoffman has pointed out, from such statistics as were available, that tuberculosis mortalities have steadily decreased for a period of over a hundred years, from 1812, when the rate in New York, Boston and Philadelphia was close to 450 per hundred thousand. This steady decrease in mortality, which had assumed interesting proportions years before the discovery of the bacillus, obviously cannot be attributed to the battle against the germ, and yet it seems readily explainable and in perfect harmony with our present conception of the tuberculosis problem.

It is now generally agreed that tuberculous disease in the adult is usually due to childhood infection and that infection may remain relatively harmless throughout life unless the resistance of the individual is lowered. In short, tuberculous disease is the result of infection plus some other factor of lowered vitality or impaired health. Hence, the causal factors of tuberculous disease become myriad in number and every factor which tends to promote individual or community health becomes a definite factor in the prevention of tuberculosis. With this idea in view, we can reasonably

account for the decrease in tuberculosis mortality, extending throughout the past century and assuming more gratifying proportions during the past few decades.

For a hundred years living conditions have steadily improved. Means of cleanliness have become readily available, fear of fresh air and night air have been abandoned together with our more absurd superstitions. Sewage disposal, water supply, safe milk and food supplies, ventilation and basic factors in health have gradually come to receive serious consideration. Childhood, the crucial point in health control, has been safeguarded by better obstetrics, better care of mother and infant and more recently by school sanitation and health activities among children based on the sane doctrine that sound bodies are as essential as cultivated minds.

Intelligent efforts in the prevention and suppression of communicable diseases—some of them notorious forerunners of tuberculosis—have made a decided impression on the mortality of the disease, as have activities in the field of housing, the prevention and relief of poverty, and other kindred health and social movements.

Thus, it appears that improved personal and community life, and general health and social activities which have gradually gathered momentum during the past century, have had more to do with reducing the tuberculosis death rate than the attack we have made on the bacillus. In fact, I am ready to believe that the improvement of general health through better milk supplies has done as much to stay the ravages of tuberculosis as anything we have done to control bovine infection, and that the effect of the general improvement of housing has been more far-reaching than our efforts to prevent disease by supervision of premises infected by the tubercle bacillus.

In attributing this gratifying showing in reduced tuberculosis mortality to the efforts made in general

health, and social fields, we must not infer that the antituberculosis organizations have in any way failed. In fact, national, state and local tuberculosis associations have not only done their part in their own special field, but they have contributed to general health to an astonishing extent. In thousands of instances, these tuberculosis associations have been the pioneers in all health activity and, while they have placed proper emphasis on their own problem, which had been so long neglected, they brought with them the first public health nurses, the first child-welfare work and the first popular interest in health which served to stimulate activities in other lines, and to strengthen the hold of the governmental agencies on the public. If their policy of a battle against the germ was narrow, it was no narrower than that of others in a day of bacteriologic enthusiasm, and their practical performance has been big and broad and helpful.

In conclusion, I should like to have it understood that I am dealing with only one phase of a tremendously big subject; that I am questioning, as every student is questioning, the various factors which have played a part in the most complex of medical and social problems, and that I do not minimize the importance of the special tuberculosis activities or the unquestioned good which has resulted from such agencies as dispensaries, sanatoriums, better medical training and the specialized educational campaigns which must always be employed in a successful warfare against the disease.

ABSTRACT OF DISCUSSION

DR. L. L. LUMSDEN, Washington, D. C.: I am impressed with the position which I understand Dr. Palmer takes in regard to our most effective attack on the great problem of tuberculosis being through the application of general health activities. One of the large life insurance companies a few years ago made a careful statistical study of the incidence of certain diseases among its policy holders and found from the data that among persons under comparable conditions, economical, social, age and so on, those who had had typhoid

fever were in the five-year period following the attack of typhoid fever much more likely to develop obvious tuberculosis than were those who had not had typhoid fever within the same period. It appears highly probable that in preventing other diseases such as typhoid fever, hookworm disease and malaria, which may be controlled by general sanitary measures, we are apt to make a definite impress on the tuberculosis rate. Economic conditions appear to influence, almost in mathematical ratio, the tuberculosis rate. Carefully compiled statistics in recent years showed that among government employees the tuberculosis rate was inversely proportionate, with remarkable regularity, to the salary scale. In the field of health activities it seems to me that more may be accomplished for immediate reduction of the tuberculosis rate through general hygienic measures and specific measures for the control of other infections than through measures directed specifically toward the control of tubercular infection itself.

DR. JUAN GUITERAS, Havana, Cuba: It would be worth while to take into consideration the development of the idea of contagion in the times preceding the discovery of the tubercle bacillus in the matter of contagion. The idea of contagion and the possible transmissibility of tuberculosis did not begin at the time of the discovery of the tubercle bacillus, and it is possible that the gradual elimination of this disease for years back began with the more or less popular idea that it is contagious, and it is worth while finding out whether this did not decrease the number of cases, or result in a diminution of the mortality in those countries in which the idea of contagion was more prevalent. I would suggest that a study be made of the statistics concerning tuberculosis in Italy, which was one of the countries in which the idea of the transmissibility of the disease, or its contagious nature, manifested itself early.

DR. JOHN P. DAVIN, New York: In connection with the theory concerning the scale of wages, the earnings and the decrease of tuberculosis as the result of a raise in wages: The better paid workman is on this account better able to provide for his needs, and the better able he is to do this the better he can live and the better citizen he should become. I have been greatly impressed by the members of the American Federation of Labor whom I have met. They are as a body a very high class of men, but the great trouble they have to overcome today is that an increasing price of the necessities of life invariably goes in excess of an increase in wages. Unless we can correct this disproportion so that an increased wage will produce or purchase something more than what it does today, we are just as badly off as we were before wages were raised. Under these circumstances I think that in addition to studying the surroundings and

improving the living conditions of the wage earner, and in attempting to eliminate tuberculosis by improving such earnings and such living conditions, we must study as well their sources of supplies; how much they have to pay for rent, how much they have to pay for food, and how much they have to pay for clothing and other necessities of life.

DR. W. C. WOODWARD, Boston: Apropos of the relation of wages to tuberculosis, we have to bear in mind that the men who receive the higher wages are presumably physically and intellectually the more capable men, and the question is not altogether whether the higher wage enables a man to avoid tuberculosis but also whether tuberculosis does not prevent him from earning the higher wage.

DR. A. T. MCCORMACK, Bowling Green, Ky.: The problem presented here, that of tuberculosis, and the solution suggested by Dr. Palmer, is extremely gratifying to everybody interested in this subject. I think it is the history of all definite movements for the relief of a definite condition in public health matters that those interested approach it, first, as experts in the particular line, and then gradually spread out over more territory and begin to take in collateral problems until eventually every worker is interested in the general problem. In Panama we found out early that respiratory disease of the laborers was one of our greatest problems. A very interesting phase of the matter was the relative incidence of the respiratory disease, which was well known in the old Spanish towns, a section of the old residential part of the Canal where the houses had not been torn down until last year. They were occupied by very poor, squalid inhabitants, and were very bad quarters, a very large number of individuals being housed in one room as compared with the newer quarters built under the plans suggested by General Gorgas, and where really decent quarters were provided. These people all received the same wages. Yet, the respiratory diseases of old Spanish towns were 900 times as frequent as in the modern town. The individuals worked together on the locks and in the mechanical division, had the same kind of work and bought their food largely from the same commissary. In approaching this problem in Kentucky, where 23 per cent. of our rejections in the draft were on account of tuberculosis, we realized that it would be impossible to have enough sanatoriums to accommodate half of the cases of tuberculosis. We are attempting to approach the problem under the supervision of the county officers and with the general assistance in every county of the local medical organization, the establishment of regular hours in a tuberculosis dispensary and having a trained public health nurse follow up the cases, using the comparatively small number of beds in our sanatoriums as schools for the tubercular and attempting at the same time to

broaden the education in such a way that all the individuals will be taught the ordinary lessons of how to prevent tuberculosis. I have been very much interested in the model Lincoln School in Lexington where they are opening free air schools on the top of the schoolhouse for children who are tuberculous, or for those who have shown symptoms of tuberculosis. It is rather poor policy that we are only taking care of those who have defects and permitting the well to be in the same class rooms and school rooms with the affected ones, and not giving them the benefit of fresh air.

DR. GEORGE THOMAS PALMER, Springfield, Ill.: Dr. Lumsden and Dr. Woodward have pointed out a very important question in the handling of the tuberculosis problem. As physicians and health officers, I believe that we feel a little jealous at times of the invasion of our field by social agencies and yet when we consider the social aspects of the disease and particularly the relationship between wage and tuberculosis, we realize that we can never make big progress in the solution of the problem without a closer touch with charity organizations and with social agencies generally. As a matter of fact, I think that one of the most important steps in the solution of the tuberculosis problem is to bring about a closer appreciation on the part of physicians and health officers of the intricate social problems involved and on the other hand to develop a closer conception on the part of social workers of the difficulties encountered in meeting the medical side of the problem. Tuberculosis is largely a social problem. In its solution we have to consider proper food supplies, proper housing, the comfort and happiness of the individual. Freedom from worry and care and anxiety necessitated a very much closer relationship than now exists between social agencies, public health officials and the medical profession. I was very glad, indeed, to have Dr. McCormack call attention to the lack of facilities for the care and protection of the well child. In our public health work and particularly in tuberculosis, we will not secure satisfactory results by making provision only for the physically deficient child and neglecting the individual in whom disease can be prevented. In dealing with tuberculosis, perhaps more than with any other disease, we realize that disease prevention is more important than disease suppression and that health promotion is an infinitely more important matter than either.

DR. W. C. WOODWARD, Boston: I hope that nothing I have said is going to connect tuberculosis with charity. A man who has tuberculosis or any other disease, and needs relief, ought to be able to get relief without being looked on as a mendicant or a pauper. As a citizen of the commonwealth or a person within the protection of the commonwealth, he is entitled to relief as a matter of moral right—or else our boasted civilization is a sham and a pretense.

THE INFLUENZA EPIDEMIC AND ITS AFTER-EFFECTS IN THE CITY OF BUFFALO

A DETAILED SURVEY

FRANKLIN C. GRAM, M.D.
Acting Health Commissioner
BUFFALO

Epidemic influenza struck Buffalo with the suddenness of a cyclone. During September, 1918, we had thirty-three cases. October 1, the disease manifested its presence with twenty-one reported cases, and, by October 14, we had the highest number reported in one day, namely, 1,886 cases, with forty-eight deaths from influenza, seven from pneumonia and seven from bronchopneumonia, making a total of sixty-two deaths in one day. This was the peak in the number of reported cases for a single day; after it a gradual decline became perceptible. The highest number of deaths occurred, October 19, with eighty-five from influenza, eighteen from pneumonia and nine from bronchopneumonia, or a total of 112 deaths for a single day. The total number of cases for October was 23,544; in November and December there were 1,846 and 2,975 cases, respectively, making a total of 29,398 cases from September to December inclusive, with a total of 2,561 deaths for the same period from influenza, pneumonia and bronchopneumonia.

January showed a considerable increase, with 4,053 cases of influenza, 140 of pneumonia and 109 of bronchopneumonia. There were 249 deaths from influenza, fifty-eight from pneumonia and eighty-one from bronchopneumonia, making a total of 388 deaths. In February the number of cases declined to 813, and in March they came down to 187.

SEPARATION OF INFLUENZA AND PNEUMONIA

Buffalo, in common with other cities, suffered for the want of physicians and nurses when the influenza epidemic struck us in October. Physicians were so overwhelmed with work that it was a physical impossibility to see most of the patients more than once. For this reason, physicians often failed to differentiate between influenza and pneumonia, but reported all cases as influenza. It was only the severest or fatal case which received more careful attention and diagnostic accuracy; hence our early reports were complete only in our mortality statistics, and it was not until the crest of the epidemic wave had passed that anything like accuracy in morbidity statistics was possible.

TABLE 1.—SUMMARY OF CASES AND DEATHS IN BUFFALO

	No. of Cases			Deaths			
Date Reported	Influenza	Pneumonia	Broncho-pneumonia	Influenza	Pneumonia	Broncho-pneumonia	Total Deaths
September, 1918.....	33	...	...	5	31	23	59
October.....	23,544	...	...	1,416	283	196	1,895
November.....	1,846	...	...	271	60	32	363
December.....	2,975	...	...	151	52	41	244
Total.....	28,398	...	...	1,843	426	292	2,561
1919							
January.....	4,053	140	109	249	58	81	388
February.....	813	57	62	97	48	46	191
March.....	187	45	49	19	43	35	97
Total for preceding seven months.....	33,451	242	220	2,208	575	454	3,237
	242						
	220						
Grand total.....	33,813						

MEASURES EMPLOYED

Verification of Statistics.—Much has been said and written about the inaccuracy of morbidity statistics relative to influenza. When Buffalo found itself in the throes of the disease, the mayor of the city, on the advice of the acting health commissioner, issued a proclamation closing all theaters, moving picture shows, churches, Sunday schools, public schools, parochial schools, private schools, saloons and dance halls,

prohibiting, in fact, all indoor gatherings. This proclamation was in force exactly three weeks to the day.

Fortunately, a street car strike occurred during practically the same period. I am satisfied that the drastic proclamation and the street car strike were responsible more than any other measures for the comparatively low morbidity in Buffalo, that being less than 7 per cent.

Organization of Schoolteachers.—By closing the schools, over 2,000 teachers in public schools became idle. Here was an opportunity which I immediately made use of by organizing them and making a house-to-house canvass of the entire city by districts.

With 2,000 teachers at my command I was enabled to accomplish much which otherwise would have remained an impossibility. First, I was enabled to check up the reported cases. As a result of this comparison I found that fully 95 per cent. of all the cases were reported, the remaining 5 per cent. being practically those in which the patients were only slightly ill, therefore deeming it unnecessary to call a physician, or those in which, for some reason or other, it had been impossible to obtain a physician. Second, patients who were seriously ill and unable to obtain a physician were immediately sent to the hospital, in some instances entire families being cared for by sending the sick member to the hospital and the contacts to a temporary isolation hospital. Third, I was enabled to do a great deal of social service by providing food, fuel or other necessities wherever required.

Hospital Facilities.—During the early part of October, a large high school building in the center of the city was quickly converted into a temporary hospital. Another building was used as an isolation hospital for contacts, and a third as a convalescent hospital for such patients as had recovered from the disease but who were unable to return home, or who had no home and were unable to work; or for the many others who

were without means and therefore unable to pay for board and lodging. Each one of these three classes was quite large, and the service performed was of the utmost value.

Red Cross Motor Corps.—No report of the influenza epidemic would be complete without special mention of the ambulance service which was organized by the girls' motor corps of the Buffalo chapter of the Red Cross. These young ladies not only drove ambulances, but many their private cars, from long before dawn until far into the night, answering calls, carrying the patients on stretchers from the homes into the ambulances, and again into the hospital, often putting them to bed.

A noteworthy incident is that, as far as is known, not a single motor corps girl contracted the disease.

INFLUENZA AND ITS SEQUELAE

Duration of the Disease.—Our influenza was like a prairie fire—short and drastic. Every influenza patient was either convalescent or dead within five days from the onset of the attack.

Sequelae.—A characteristic of the acute infectious maladies is their proneness to leave certain after-effects, and while the particular conditions liable to follow the principal maladies are generally known, much remains unknown, particularly as regards the determining factors, individual susceptibility and the extent to which each after-effect may be anticipated in a given epidemic visitation.

Influenza is one of the most serious of the infectious diseases, and is capable of exerting its fury on many of the vital systems of the body, so that a wide range of after-effects may be observed. Notwithstanding, it is noteworthy that exact knowledge and data concerning all that pertains to these sequelae are wanting. Writers speak of tuberculosis and bronchial affections, nervous affections, serious affections of the eye and

ear, a disposition to awaken latent maladies and create a predisposition to others as among the sequelae, but they do not furnish information as to the ratio of these sequelae to the whole, or of the particular influences that determine them, all of which can have a practical bearing, both in prevention and in general treatment.

The epidemic of 1889 and 1890 showed that the greatest number of deaths did not occur in association with the attack itself, but rather in the following two years, the explanation being that the malady left undermining conditions, weaknesses and lessened resistance, thus rendering the individual vulnerable to subsequent ailments proving fatal.

From this it would appear that the general condition in which the individual is left immediately following the attack is of much importance, the subsequent element of time permitting valuable reconstructive treatment.

THE SURVEY

With the fact in mind that probably no investigation of the numerical relations between the malady and its sequelae had ever been made, and that the findings of the epidemic of 1889 and 1890 showed time to be an important asset in postinfluenzal conditions, I determined to institute a survey of the recent epidemic in Buffalo to ascertain the percentage of sequelae, and, incidentally, to gather such other data as appeared pertinent, and, finally, to secure reconstructive treatment where indicated.

Dr. Herman M. Biggs,[1] health commissioner of the state of New York, said:

> In the last great epidemic of 1890, 1891 and 1892, the greatest mortality occurred in 1891, the second year, although all three of these years showed a larger death rate from the acute respiratory diseases in New York City than had been experienced before for many years. It is not possible to assess even approximately the extent of the loss which influenza has brought and will bring to the country. On the sickness and the death rate we find its malign influence. The

1. Biggs, Herman M.: Review of Reviews, January, 1919.

present indications would seem to show quite clearly that the deaths from influenza and its complications in the United States during the present year will probably exceed 300,000.

The *Survey* of Feb. 22, 1919, contains the following:

The Metropolitan Life Insurance Company made a study of its experience among industrial policies following the epidemic of 1889. The results show that the greatest number of deaths from pneumonia and all causes did not fall in the epidemic year, but in the years following—most heavily from 1891 to 1893; in other words, that the patient who survived the Flu was weakened and was carried off by some subsequent illness.

Immediately after the pandemic subsided, I endeavored to determine these conditions in Buffalo by an actual investigation. If we had as a result of influenza a larger number of our people suffering from tuberculosis, heart troubles or other organic diseases, we should by so locating them immediately learn whether they were being cared for by their own physicians and at a time when treatment might be most effective, and if, for any reason, they were not receiving proper attention, we could assist in securing whatever medical or other aid was needed.

With that object in view, I had follow-up cards printed containing the names and addresses of every influenza victim since October 1. I directed the physicians, nurses and inspectors who are regularly employed in the various bureaus of the department of health to take a certain number of cards with them on their daily inspections and attend to this additional work. After about six weeks of effort, only approximately 8,000 such calls had been made, and it became apparent that this method would take too long, and that, if the information relative to influenza victims was to be of any service, it must be had within a shorter time.

I therefore appealed to the mayor and to the city council for a sufficient appropriation to employ extra help and make the investigation immediately. This

authority was granted. The field work was done by extra inspectors appointed for the purpose, and paid for by the emergency appropriation. They were given the cards containing the names and addresses of the patients, and instructed to obtain answers to all the questions contained thereon.

These printed cards, used by the canvassers for their field investigations in obtaining an after-influenza record, contained the following:

> Name of patient. Address. Number in family. Was father ill? Was mother ill? What other members were ill (giving names and ages)? Are all patients fully recovered? If not recovered, give particulars. Any deaths (give names)? Name of attending physician. Does family need: (1) medical or nursing care; (2) relief or other assistance? Housing. Number of rooms. Sanitation. Special remarks.

This covered the information required for the crude field work. The details were accomplished through subsequent visits by medical inspectors from the department, or by telephone communication with the attending physician.

The city was divided into districts, and an inspector was assigned to ascertain from each person in his own words whether his recovery had been "complete," or, if not, to what his impairment was due, as learned from his attending physician. Those reported as recovered and again performing their usual occupations were immediately classified as such. All patients whose conditions could be considered as properly associated and worthy of scrutiny as to their nature and ultimate possibilities were referred and made subjects of direct communication with the attending physician; if no physician had been in attendance, a physician from the health department was detailed to investigate. Thus, a complete survey was made of all who had had the disease, and, when recovery was not complete, further investigation was pursued in those cases in which it was deemed proper.

The difficulties attending such work are not slight. Individuals are frequently not responsive and resent interference, so that much tact is essential.

The field work occupied a period of approximately two months, but the cards were compiled daily, and cases requiring medical or other aid received immediate attention. In Table 2 are shown the extent and the results of the survey.

TABLE 2.—RESULTS OF THE SURVEY

Total cases of influenza and pneumonia reported from Oct. 1, 1918, to March 31, 1919		33,880
Number of calls made by physicians, nurses and inspectors (without expense) of the department of health	8,000	
Number of calls made by extra canvassers and inspectors	17,699	
Total calls		*25,699
Total deaths from influenza (October to March, inclusive)	2,248	
Deaths from pneumonia	528	
Deaths from bronchopneumonia	403	
Total deaths from these three causes (October to March, inclusive)		3,179
Recovered		28,663
Not located (changed residence)		1,290
Patients not fully recovered		748
Total cases		33,880

* These 25,699 calls covered the 33,880 cases, some families having more than one case.

The character and the number of the sequelae occurring in 748 cases, as disclosed by this survey, are shown in Table 3.

TABLE 3.—CLASSIFICATION OF THE SEQUELAE

Respiratory system	220
General diseases (rheumatism, weakness, etc.)	206
Special senses (ear 51, eye 26, nose and throat 23)	100
Circulatory system	46
Nervous system	46
Urinary system	23
Subsequent infections	19
Alimentary system	14
Miscellaneous (unclassified, pains, etc.)	74
Total sequelae	748
Referred to superintendent of poor for immediate assistance	20
Referred to health centers	15
Referred to bureau of sanitation	9
Referred to school examiners	1
Total referred cases	45

An analysis of the 220 patients reported to have some form of trouble pertaining to the respiratory system was then made by medical inspectors of the department, and led to the information given in Table 4.

TABLE 4.—ANALYSIS OF RESPIRATORY SEQUELAE

Coughs (recovered since original report)	99	
Coughs (improving)	43	
		—142
Tuberculosis:		
Cases reported prior to epidemic	11	
Suspected tuberculosis (still under observation by attending physician)	8	
New cases of tuberculosis (several in families with a tuberculous record)	8	
Suspected tuberculosis (after continued observation and repeated examinations pronounced nontuberculous)	1	
		— 28
"Colds" recovered		13
"Lung Trouble" recovered		12
Miscellaneous (bronchitis, pleurisy, empyema, asthma, etc., recovered)		21
Deaths (from various causes, one being tuberculosis)		4
		220

A further analysis of the 206 cases classified under "general diseases (rheumatism, weakness, etc.)," disclosed that 128 of these patients had recovered and seventy-eight were improving. The subsequent reports on the remaining complications are given in Table 5, showing the final record of recovery and improvement.

SUMMARY

1. A final, detailed analysis, carried out as far as possible to the present time, is exceedingly gratifying, showing that out of 748 cases found on the first examination to have some form of sequelae, 501 patients have since recovered, and 216 are reported as improving. The nature of the reports indicate that practically all of the 216 will, in the near future, likewise be discharged as recovered.

The four deaths reported since the primary investigation may or may not have been due to influenza sequelae. The question is debatable both ways, as no one can say that in the natural course of events the

patients would not have died even if they never had had influenza. Only one death out of the four was caused by tuberculosis, and the history of this case was such that, although not a reported case prior to the influenza epidemic, there is a strong probability, according to the history given, that the patient was already suffering from tuberculosis before he contracted influenza.

TABLE 5.—RECOVERY AND IMPROVEMENT AS REVEALED BY FURTHER INVESTIGATION

Ear:		
Recovered	38	
Improving	13	
		— 51
Eye:		
Recovered	21	
Improving	5	
		— 26
Nose and throat:		
Recovered	19	
Improving	4	
		— 23
		100
Circulatory system:		
Recovered	27	
Improving and under physician's care	19	
		46
Nervous system:		
Recovered	30	
Improving	16	
		46
Urinary system:		
Recovered	18	
Improving	5	
		23
Subsequent infections:		
Recovered	11	
Improving	8	
		19
Alimentary system:		
Recovered	12	
Improving	2	
		14
Miscellaneous (unclassified, pains, etc.):		
Recovered	51	
Improving	23	
		74

This brings us down to what, by many health authorities, is considered the most important definite knowledge for practical purposes, that pertaining to the twenty-seven cases of tuberculosis. Out of this number eleven were already on our records as reported

cases of tuberculosis before the influenza epidemic began, and must therefore be eliminated from the number which could possibly be charged to influenza.

Eight cases still classed as suspected tuberculosis are under present observation, with no definite diagnosis.

This leaves only eight cases reported since the epidemic of tuberculosis among patients who had influenza, and several of these were in families with a tuberculous record.

2. This survey definitely established the entire after-influenza situation in Buffalo.

3. With more than 2,000 public school teachers at our command for a house-to-house canvass, we established the fact during the influenza epidemic that practically all influenza cases in the city of Buffalo were reported.

4. So far as is known, no other city in the country made a similar canvass during the epidemic, or a similar after-influenza survey.

5. Every possible care was exercised to make both the canvass and the survey as accurate as possible. Both were made by dependable persons. We cross-checked the records. Reexaminations and subsequent visits were made until the status of every case was definitely decided.

6. The fact that only twenty persons who had had influenza required immediate assistance from the superintendent of the poor speaks well for the residents of Buffalo.

7. It is shown that the number of sequelae are relatively smaller than anticipated and that their character was generally not as severe as indicated in many statements issued.

8. The first important observation is the small number of sequelae. As stated, with a malady of such capacity, a greater number would be anticipated.

9. In contradistinction to observations relative to previous epidemics, I do not anticipate any serious

results among the persons who had influenza in Buffalo and recovered. Our mortality appears associated and not deferred.

10. While our mortality rate from influenza and pneumonia was large, our morbidity rate was relatively small, being less than 7 per cent.

11. One fact is definitely established, and that is that we have nothing to fear from tuberculosis as a sequela to influenza in Buffalo. I do not consider eight cases with a definite diagnosis of tuberculosis more than we would ordinarily look for among 33,880 individuals.

12. I believe the same may be said of the other cases classed as "improving." This number also is not larger than that which would ordinarily be expected with some organic trouble among so large a number of individuals.

13. The salient features presented by this survey show:

(*a*) The small number of sequel relative to the whole number of influenza cases.

(*b*) Their character, at variance, in general, with the type of sequel and consequences as recorded by most writers.

(*c*) The high percentage of recovery after a period of several months, and the nondevelopment of any considerable number of intercurrent affections, which are apprehended and most prone to develop.

(*d*) The frequent sequel of mild eye, ear and throat affections—100 cases in 748, or about one in seven; and the high percentage of recoveries without permanent after-results.

(*e*) The demonstration, by results, of the value of early and vigorous preventive measures, such as publicity regarding the necessity for personal and general hygiene; the closing of schools, churches, theaters, saloons, and, in fact, prohibition of every public assemblage or gathering of more than ten persons; the wearing of masks; the use of prophylactic vaccines; the

organized facilities and provision for hospital care and treatment; the care and isolation of contacts, and the care of convalescents in suitable convalescent homes or hospitals, and at public expense when necessary.

(*f*) Few cases of sequel affecting the alimentary system (the affections which occurred being of the stomach, and not intestinal).

14. Credit for this showing properly belongs to the Buffalo Department of Health, backed by the mayor and council, for their prompt, aggressive, vigorous and unrelenting measures, instituted at the beginning and maintained throughout the course of the influenza epidemic.

ABSTRACT OF DISCUSSION

DR. A. LEO FRANKLIN, Cumberland, Md.: I wish to ask Dr. Gram whether we understood him correctly that out of the total of 28,000 recovered patients, examinations were actually made on approximately 748?

DR. FRANKLIN C. GRAM, Buffalo: No. Every case that was reported was examined. The cases of recovery were immediately eliminated, leaving only 748 for special investigation.

DR. FRANKLIN: In other words, it was estimated that no examination was made of those that recovered completely.

DR. GRAM: That is the effect of it.

DR. FRANKLIN: If that is the case, I fear that we might possibly go astray if we were to assume from the comparatively limited number of patients who were reexamined, that they were not affected in one way or another by the after-effects of influenza. The experiment made in Buffalo would have been much more valuable if it had been possible to take several thousand of these apparently recovered patients and apply a careful medical examination to ascertain whether there were any after-effects. In Boston, an examination of that kind indicated there were decided after-effects. Similar studies have been made in other cities which seem to give the same results. Similar discoveries are being reported by medical practitioners. There is nothing at the present time that we need to be so careful of as these after-effects of influenza. After the epidemic of 1889 there was a continued high mortality, and it was not until approximately five years afterward that the general mortality of such cities as Philadelphia, New York, Chicago and Boston got back to the normal. Whether this is due to influenza, no one is in a position to say, but I believe we ought to be exceedingly careful at this time not to draw any conclusion not war-

ranted by the facts, and furthermore, it is necessary, in my opinion, to make an exceedingly intensive study in certain communities to determine whether influenza is leaving these after-effects or not.

DR. E. B. FREILICH, Chicago: In October, 1918, at the height of the influenza epidemic in Chicago, the physicians and nurses in the eight dispensaries comprising the field department of the Chicago Municipal Tuberculosis Sanitarium were directed by the commissioner of health to discontinue the regular tuberculosis work and take care of the nontuberculous as well as the patients registered with the dispensaries. We were impressed with the fact that of about 3,500 patients registered at our dispensary, only thirteen were referred to us with influenza. This observation was corroborated by the dispensary physicians in the other districts and as a result a survey was ordered of these cases. Out of 8,500 patients treated, we had fifty-one patients who were registered with the dispensaries; an incidence of about 0.6 per cent. In the Cook County Hospital and in Oak Forest, where advanced cases of tuberculosis are treated, eighty-five cases of influenza were found among 1,551 persons; an incidence of 5.4 per cent. Based on these observations, we concluded that individuals with active tuberculosis had a diminished susceptibility to the influenza infection. On the other hand, in the past six months we have observed in our dispensary clinics, almost daily, moderately advanced and advanced cases of tuberculosis with a history dating back to an influenza attack in the past year. We concluded from our clinical observation at the dispensaries that individuals with latent tuberculosis may have their conditions aggravated by the influenza infection. The attendance at our dispensary clinics has increased largely due to the influenza epidemic on account of respiratory complications following in the wake of the epidemic and on account of the active campaign now being carried on against tuberculosis in our city.

DR. B. R. WAKEMAN, Hornell, N. Y.: In Hornell, a city of 15,000 people, 2,896 cases of influenza were reported during the epidemic of October and November, 1918. Early in January we made a postinfluenza survey. Out of this number 700 persons had not fully recovered. Nearly 400 were examined in the clinic by the superintendent of the county tuberculosis hospital, an expert diagnostician. Forty persons were found to have tuberculosis. From January 1 to October 1, 1918, only two cases of tuberculosis had been reported to the health officer. The postinfluenza survey had so stimulated the interest of the community that over fifty cases of tuberculosis have been reported since October 1, 1918. The epidemic possibly may not have reactivated all of these cases of tuberculosis, and this increase may have been due, to a slight extent, to the campaign of publicity.

Nevertheless, my personal opinion is that influenza in our locality has materially increased our cases of tuberculosis.

SIR ARTHUR NEWSHOLME, London, England: Influenza was the reason for much critical newspaper publicity of public health possibilities both in England and in America. One has to realize the importance of public health authorities in facing this bane. In England it was stated that we could get no farther unless we had a minister of health and placed in his hands the machinery for handling influenza! We remain almost helpless in the prevention of acute respiratory diseases in contrast with our control over such diseases as typhus, enteric fever, diphtheria and also tuberculosis. We may hope that with the extensive pathologic and epidemiologic investigations now being pursued, we shall in a few years be able to place these acute respiratory infections on our list of preventable diseases, but we have no immediate hope of this being realized. I was interested in what was said about the relation between tuberculosis and influenza. So far as our national statistics in England are concerned, every years showing an excessive death rate from influenza, has been followed by a year in which the death rate from tuberculosis has been excessive. Many deaths from tuberculosis are undoubtedly hastened during an epidemic of influenza. I was interested in the statement that influenza has been actively present since 1889. Has this been so? Is the recent outbreak the same influenza that we have had each year, or is it another influenza? Do we at intervals from some unknown source obtain a more virulent influenza, or is it an old influenza, which has become more virulent under conditions of which we are at present totally ignorant? That is the problem. It may be one or the other, but the rapidity with which the more virulent influenza spread right through the civilized world under war conditions no doubt facilitated by the immense increase in facilities for conveyance, is one of the most striking things in the medical history of the world. It seems to me that unless medical science is able to prevent ordinary catarrhs and to prevent them from becoming something more serious, it is unlikely that we shall be able to control influenza epidemics.

DR. VICTOR C. VAUGHAN, Ann Arbor, Mich.: As Sir Arthur has said, it is still a question whether endemic and virulent influenza are one and the same thing, varying only in degree of virulence. I am collecting data bearing on this matter and I have one or two things that apparently bear strongly in one direction. In many camps in this country in March and April, 1918, we had typical influenza. It came suddenly, lasted for a few days, and disappeared as quickly as it came. Such an epidemic at Camp Forrest was ably studied and reported at the time by Major Soper. At another camp at Hattiesburg, Miss., there was in April a division of troops

numbering about 26,000. An epidemic of mild influenza struck this camp in April, 1918, and within ten days there were about 2,000 cases. This included not only those who were sent to the hospitals but also those who were cared for in barracks. This was the only division that remained in this country without change of station from April until the fall of 1918. During the summer this camp received 20,000 recruits. In October, 1918, the virulent form of influenza struck this camp. It confined itself almost exclusively to the recruits of the summer and scarcely touched the men who had lived through the epidemic of April. Not only the 2,000 who had the disease in April but the 24,000 who apparently were not affected escaped the fall epidemic. It appears from this that the mild influenza of April gave a marked degree of immunity against the virulent form in October. There is another observation which points the same way. Looking over the statistics of the fall epidemic in cities in the United States we find that certain cities had a low death rate, while others had a relatively high death rate. Among those cities which had a low death rate we will mention Atlanta, Ga.; Kansas City, Mo.; Detroit, Mich., and Columbus, Ohio. Going to the spring records of these cities we find that in all of them in March and April of 1918 there was an unusually high death rate from pneumonia and undoubtedly in these cities at that time there was a relatively mild epidemic of influenza. In this way I am inclined to account for the relatively low death rate in these cities in the fall of 1918. I make no claim that this and other instances of a similar kind prove that the mild and virulent forms of influenza are manifestations of the same disease, but I do hold that the evidence points that way. I want to call attention to the fact that sanitation, as we ordinarily understand it, had no influence on the prevalence or the death rate from influenza.

DR. WILFRED H. KELLOGG, San Francisco: I want to call attention to a very significant fact, which is, that the mortality statistics for the last five years show a very rapid increase in deaths ascribed to influenza. I first noticed in the figures for California that for every succeeding year during this period the reported mortality from influenza has increased. The reported deaths from influenza have jumped to almost double for each year for a period of five years and I observe that this is true also of the reports of the United States Census Bureau for the registration area. Now, this suggestion: That our influenza epidemic was not due to the importation of a virulent strain from Europe but was due to an increase in virulence which was simultaneous throughout the world.

DR. H. D. WOOD, Providence, R. I.: It may not be generally known that during the summer of 1917 there was a streptococcic sore throat going throughout the army. We

had it in the West Virginia camps, and they were sent from there into Ohio, Maryland, Virginia and elsewhere. There was no influenza, no respiratory conditions, except the spitting of blood, but the hemolytic streptococcic sore throat spread throughout the United States.

DR. L. I. DUBLIN, New York: We have been for some time engaged in analyzing the returns concerning our company, and it may be of some interest to give you knowledge concerning the preliminary finding. They will point, I think, very significantly to some conclusions. In the first place, we find in regard to this disease, from the mortality returns, that the heaviest instances of the disease are localized, the death rate experience. This experience includes some twelve millions concerning whom we know a great deal. We find from the curve that these increases in mortality rates from the epidemic of influenza and pneumonia are localized in the ages 15 to 50, getting at their height at the ages 25 to 29. That is true not only for the industrial, but the intermediate and the ordinary groups which represent millions of policyholders, affecting one, the same in all three groups, but varying somewhat in the height of the curve. Then, we find a very marked difference in the sexes, 25 or 30 per cent. in favor of the females. Then, there is a marked difference in races. The colored people show a very much lower mortality rate at these same age periods than do the white people. Of course, the curve was the same; the peak was between 25 and 29. There are certain age periods where the effect was virtually negligible, at the age of 50, but at the height of the curve, from 15 to 50, the rate was conspicuously lower for the colored than for the white race. There is also a localized incidence, highest for the males, for the white males, and also localized at from 15 to 50 years of age. Finally, the highest instances are observed along the Atlantic seaboard; that as we go inward, into the interior, we find a lessening of virulence as indicated by the death rate, being lowest as we approach the Pacific coast, with one exception, and that we do not understand. That is San Francisco. It is quite possible, however, that in that city we are concerned with a double infection, that is, one coming from the East and being of a small caliber, and the other coming by way of the Panama Canal, or perhaps from Asia, because the period of highest incidence in San Francisco as in a few other places on that coast, where the figures are available, was the highest curve, and several weeks in advance of interior points. It is, therefore, quite possible that the infection was brought in in two different ways.

DR. CHARLES J. HASTINGS, Toronto: Soon after the declaration of the war that we have just passed through there was a very valuable and significant pamphlet published and circulated broadcast throughout the country, entitled

"Know Your Enemy." I think that we had better recognize the importance of this and acknowledge the fact as promptly as possible, that we do not know our enemy in the pandemic we have just passed through. Various organisms have been found present, and numerous strains of each, and there have been cases where they have all three been present and where one only has been present. So that we are not justified in saying that any one of them is the cause of the disease. This being the case, we must assume that we do not know what is the cause of this disease. It may possibly have been a malignant form of the mild influenza of former years. I am sorry to learn that there are yet a few who have some faith in vaccines, and who claim to have had wonderful results from their use. That there is a tremendous amount of virtue in vaccines cannot be doubted, but how can we claim to have a valuable vaccine when we do not know what we are preparing it for? Until we know the organisms that cause the disease, we cannot hope to have an efficient vaccine. We must recognize the fact that vaccine is along the right line. We hope that a vaccine will be perfected and will have the desired results, but do not let us continue to claim that we have an efficient vaccine at present, which I am satisfied we have not.

DR. FRANKLIN C. GRAM, Buffalo: It would be impossible to cover the many points alluded to, but I want to refer to the one that Dr. Frankel presented. We had to eliminate, for the present survey, all those who were found to be recovered and who had returned to their work. A survey of this kind is extremely difficult to make, even at best. When you go to a home, and they tell you that the patient has recovered and has returned to work, it is a difficult problem to follow that case up, as most people resent interference; this is aggravated when you have about 33,000 cases to deal with; for that reason we confined our efforts principally to those who had some form of sequel. The present mortality has been alluded to as being increasing, but in Buffalo it is down to normal. Of course, it is impossible to say what the future will produce.

PROGRESS OF VENEREAL DISEASE CONTROL

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To indicate briefly a few of the actual achievements of the division of the Public Health Service entrusted with the direction of the campaign against venereal diseases in cooperation with the state agencies of the country; and to indicate briefly, also, what the year's experience has taught concerning the future development and advance, is my purpose in this paper.

It will be recalled that on the declaration of war the U. S. Public Health Service was given the responsibility, by Congress and presidential order, of supervising sanitary conditions in the zones created around military establishments. The comprehensive program promptly outlined, whereby this task might be fulfilled and the health of the fighting forces protected at the avenues of civilian communication, included, among other measures, the proper supervision over water, food and milk supplies; the proper disposal of human excreta; the elimination of breeding places of flies and mosquitoes, and the efficient control of communicable diseases, including gonorrhea and syphilis.

FORMULATION OF A PLAN OF CONTROL

For the control of venereal diseases in these zones, special measures were necessary. These measures were based on the findings of other countries during the war, as they attempted control of venereal diseases, and on special investigations showing an inevitable

relationship between liquor and prostitution, and prostitution and venereal disease. The measures had the authoritative support of Sections 12 and 13 (afterward Chapter 14) of the Selective Service Act, Section 12 prohibiting the sale and distribution of liquor to the troops, and Section 13 (afterward Chapter 14) controlling the activities of prostitutes in and near the zones. But it was not sufficient to protect the soldiers, sailors and skilled laborers within the boundary lines of cantonments or industrial plants.

Previous war history had indicated definitely that epidemic disease is contracted not so much in reservations under military control, as in municipal areas with unsatisfactory sanitary control. It will be recalled that five-sixths of the venereal infections among men who entered military service had been incurred in civil communities before they reached camp. Hence the program for combating syphilis and gonorrhea was formulated on a nation wide basis and was put into effect with the increasing cooperation of state boards of health.

Jan. 2, 1918, the following telegram was sent to all state health officers by the Surgeon-General of the United States Public Health Service:

> Control venereal infections in connection prosecution of the war constitutes most important sanitary problem now confronting public health authorities of United States. Plan of control mailed you today. Request your cooperation forceful enforcement same. Venereal infections should be made reportable, and quarantinable. Means of diagnosis and cure should be provided. Campaign wisely conducted publicity should be launched. Please inform me your action in premises.

This was followed at once by a letter confirming the telegram and further stating that:

> It is evident that the prevention of venereal infections in the military population is largely dependent on the degree with which these infections are prevented in the civil community. This imposes on the civil health authorities the duty of forcefully attacking the venereal problem on the basis of the control of communicable disease . . .

With this letter was forwarded an outline, a working plan, tentative, since no plan could be at once devised which in all phases met the necessities of every state. The outline of that plan is as follows:

1. Epidemiology of venereal disease.
(*a*) Peculiar to the human species.
(*b*) Chronic diseases.
(*c*) Spread by contact—not necessarily sex contact—chronic carriers.
(*d*) Very prevalent in all classes of society.
(*e*) Most prevalent in classes of low inhibition.

2. Control of venereal disease.
(*a*) Depends on the control of infected persons.
(*b*) Control of infected persons depends on knowledge of their whereabouts. This may be determined by:
  (1) Morbidity reports by serial number (in the case of private practitioners), name to be disclosed when infectious persons cease treatment. Case then followed up by health department, which enforces quarantine act.
  (2) Morbidity reports from venereal clinic and hospital.
  (3) Legal enactment necessary to secure morbidity reports.
  (4) Enacting and enforcing ordinance requiring pharmacists to keep record (open at all times to health department) of sales of drugs for the prevention and treatment of gonorrhea and syphilis.
(*c*) Object of this control is to prevent contact between infected and noninfected persons.
(*d*) May be obtained by:
  (1) Quarantine of infected persons.
  (2) Cure of infected persons.
  (3) Education of general public to avoid direct and indirect contact with persons infected or presumably infected.

3. Quarantine of venerally infected persons.
(*a*) Those who desire and can afford treatment.
  (1) These are instructed by their physicians and theoretically are thus quarantined.
(*b*) Those who desire cure and cannot afford treatment.
  (1) Means should be provided for free treatment.
    (*a*) Accurate diagnosis.
    (*b*) Dispensary relief.
    (*c*) Hospital relief.

(*c*). Those who are careless or wilful in the distribution of these infections through promiscuity.

(1) These, for the most part, are the ignorant or the criminal classes. A careful physical examination of all persons entering jails or other public institutions should be made, those found infected to be isolated, either in a special hospital or under a probation officer who enforces dispensary relief.

4. Cure of venereally infected persons.

(*a*) Establishment of venereal clinics by health authorities.

(1) Federal, in zones in close contiguity to cantonments.

(2) State, in situations in which local authorities refuse or fail to establish a clinic.

(3) City, particularly by those cities in which commercialized or clandestine prostitution flourishes for the patronage of soldiers but is beyond the authority of the secretary of war.

(4) Country, in thickly settled rural communities.

(*b*) By the creation of new, or the utilization of existing, hospital facilities.

(1) For the treatment of those who volunteer for treatment.

(2) For the obligatory treatment of persons under control of the courts.

(*c*) By legal enactment.

(1) Declaring the venereal infections to be quarantinable.

(2) Substituting confinement to hospital for confinement in jail in the case of those convicted by courts and having venereal infections.

(3) Substituting remanding to a probation officer for the imposition of fines.

(4) To carry out 2 and 3, it is necessary that all persons arrested be examined by the city physician or other authorized person.

(5) By arrest of acknowledged and clandestine prostitutes by policewomen.

5. Public education regarding venereal diseases.

(*a*) Relieve the problem of all moral and social issues and place the campaign solely on the basis of control of communicable disease.

(*b*) Propaganda of wisely conducted publicity.

(1) Through public meetings addressed by forceful speakers.

(2) Through public prints.

(3) By placarding public toilets, placards to emphasize dangers of venereal diseases and to recommend prompt treatment, either by a competent physician or at the free venereal clinic.
(4) By follow-up work by social workers.
(5) By the education of infected persons.
  (*a*) By physicians in private practice.
  (*b*) By the venereal and clinic hospital.

CLINICS AND LEGISLATION

The first step in this plan was the opening of clinics. The necessity for prompt protection of the health of military forces had placed on the resources of local communities a greater demand than they could fulfil. The first United States government clinic for the treatment of venereal diseases was opened in November, 1917, at Newport News, Va., one of the principal ports of embarkation. This clinic was operated under the joint auspices of the U. S. Public Health Service and the American Red Cross. A chain of twenty-six such clinics was rapidly established in the extracantonment zones, and their work was emphasized by the program put into effect in adjacent cities. Later, as state boards of health accepted their allotment of federal funds (presently to be mentioned) for control of venereal diseases, other clinics were established until, at the present time, fully 250 clinics where venereally infected persons may receive treatment without charge are listed throughout the country.

Another part of the program promptly put into operation was that of legislation. In March, 1918, *Public Health Reports* contained regulations whereby the state departments of health might control venereal diseases, regulations which were approved by the Surgeon-Generals of the Army, Navy and Public Health Service, and in less than a month thirty-two states had put the suggestions into active operation, either by adopting new regulations necessary to meet the situation, or by taking laws already on their statute books, out from the "dead letter" classification.

NATIONAL APPROPRIATION

The activity and cooperation achieved during the first months of the war were greatly stimulated by act of Congress, July 9, 1918. At that time the Army appropriations bill was passed, Chapter 15 of which created an interdepartmental social hygiene board and a division of venereal diseases in the U. S. Public Health Service, and carried an appropriation of $4,000,000 for the essential activities and extension of this work during the two-year period ending June 30, 1920. The special section making this appropriation is familiarly known as the Chamberlain-Kahn act. From this time the activities of venereal disease control centered in the new division of the service created under the terms of this section.

The responsibilities assigned to this division were threefold: first, to study and investigate the cause, treatment and method of prevention of venereal diseases; second, to cooperate with state boards of health in carrying through a program of control and prevention; and third, to promulgate and enforce interstate quarantine regulations covering the travel of venereally infected persons. The $1,000,000 appropriated under Section 6 of the Chamberlain-Kahn act, for allotment on the per capita basis to the various state boards of health, was promptly allotted to those state boards of health which fulfilled the regulations issued by the Secretary of the Treasury, containing requirements and standards. These regulations included the following points:

1. Syphilis and gonorrhea must be reported either under a state law or a state board of health regulation having the effect of law.

2. An officer of the Public Health Service shall be assigned to each state receiving the allotment, to cooperate with the state health officer in supervising venereal disease work in the state.

3. The allotment itself shall be expended on standard lines, 10 per cent. being assigned to administration, 50 per cent. to treatment, and 20 per cent. each to repressive and educational measures (the reprint containing the regulations in full is included in the exhibit of the service).

No financial condition was attached to the allotment for the first year. To receive an appropriation for the coming year 1919-1920, each state will appropriate a sum equal to that received from the federal government. It is of interest to know that up to the first of June thirty-two states had already appropriated the quota entitling them to receive an allotment for the second year of this fund.

In addition to this congressional appropriation, a further stimulus was given to the work of the service by the presidential order of July 1, 1918, placing all civilian public health activities conducted by federal agencies under the Public Health Service. An exception was made of the Bureau of Labor Statistics, which was investigating vocational diseases, shop sanitation and hygiene.

ONE YEAR'S WORK

The first year's work of the division has emphasized the cooperation with state boards of health, in a nationwide effort to eradicate venereal diseases. In this effort, forty-four states are at this time actively cooperating. Of the four remaining states, two have not yet passed the necessary state laws or regulations which would bring them under the provisions governing the allotment, but may do so before the close of the present legislative session.

Regulations controlling the interstate travel of venereally infected persons were promulgated, Nov. 22, 1918. This, it will be recalled, was another duty of the division defined in the Chamberlain-Kahn act creating it. The third obligation, to study the causes and the treatment of venereal disease, will be met as accumulated records and case histories supply the authentic social data for tracing deep seated causes and providing treatment of the needed scope and duration. Meantime, more is known of the causative organisms and the mode of transmission than is being

put into actual practice for prevention. The immediate necessity was for action. Research in sociological as well as medical fields is also especially provided for in the terms of the Chamberlain-Kahn act.

MEDICAL ACTIVITY

The four lines of the division's activity may be generally described as medical, educational, legislative and social.

Conspicuous in the medical work has been the establishment of the clinics for the diagnosis and treatment of venereal disease. The rapid increase in number of these clinics has already been mentioned; but the need for establishing yet other such centers of advice and treatment cannot be overemphasized. It is futile to educate people on the subject of venereal infections if no place is provided to which they may go in their aroused interest or anxiety.

The relation of the venereal clinic to other clinics of the department of health or health centers, their location in parts of the city accessible to various social groups, their provision for service in evening as well as daytime hours, and their equipment and personnel are matters of greatest importance in the control of syphilis and gonorrhea.

No less important, also, is a further deepening of the interest of general hospitals in this work, in order that beds may be available for patients who must remain under detention for treatment, since they cannot or will not take care of themselves; and also for venereal patients needing special medical or surgical care during their period of infectivity. A striking development of the work in certain hospitals in which wards are provided for patients of the "carrier" type is the introduction of vocational work, as well as recreation of suitable kind, in order that the patient who for the first time, perhaps, has learned the significance of this disease, may not simply be cured physically and then

set free to resume a life of prostitution (if that be the source of infection), or allowed to return to society not better safeguarded than before against the physical temptations of the old existence. Even the preliminary reports of such attempts available thus far are encouraging. A certain business firm sends experts to one such hospital ward to train the patients in their particular industry, carries them by number on the payroll, and accepts them as regular employees when they are discharged from the hospital.

This is no utopian state dreamed of and vaguely hoped for. It is a practical application of vocational therapy to this new group of patients, whose potentiality to society for good or ill is most significant.

In hospital and in clinic alike the opportunity for thorough mental examination is evident. During the period of observation and treatment of venereally infected patients, subnormal types should be separated from the normal, and provision made either for the permanent care of those whose mentality is too low for them to face the social and economic demands of life, or for the training of those who may attain a degree of economic independence under adequate supervision. At this point it is not necessary to do more than mention the relation of this program to efforts for better state reformatories and for the industrial farms where, in addition to vocational training, the benefits of continual outdoor life may combine for the rehabilitation of the patient.

Before passing from this mention of medical measures in the venereal program, a word must be added concerning the urgent request sent to physicians by the service that they cooperate in reporting gonorrhea and syphilis under their state laws and regulations, as other communicable diseases are reported. The decision is with the individual state or city whether these reports shall be made by serial number or by name, and the procedure varies in various localities. That the serial

number is perhaps in many circumstances the more satisfactory method is explained by the fact that the responsibility for the patient represented by the serial number is left precisely where it belongs, namely, on the individual physician who is treating the case. This is of advantage to the physician in that it allows him to study the case from beginning to end. It is of advantage to the patient who has given his confidence to the physician.

A special opportunity for highly trained work is increasingly evident as the clinics multiply and develop. This is for follow-up work, which the service believes can best be done by graduate nurses with additional training to meet the social aspects of the problem.

There is evidence, too, that as in the case of other well established clinics, the venereal clinic is becoming a place of special consultation and of experience and training for physicians and older medical students, and that it will play a conspicuous part in the teaching of syphilology.

EDUCATIONAL OPPORTUNITY

When the service speaks of educational measures the term implies explanation and, when necessary, warning to the public with all truth and frankness concerning these diseases so long held to be "unmentionable." It is maintained that the information given to the public should be frank without being unnecessarily frightful; that it should emphasize the means of preventing infection, recognizing, however, among these means, not simply treatment itself, but the no less truly therapeutic measures of improved moral, educational and social conditions.

In special relation to the teaching of children on matters of sex and reproduction, the educational material published by the service emphasizes the importance of home teaching. The consensus of opinion (as evidenced in many conferences) of teachers from schools, colleges and universities of many sec-

tions of this country is that courses of sex hygiene in schools should be not distinct in themselves, but that the information should be given simply and unobtrusively in connection with courses in botany, biology, civics, history, etc. The value of poster exhibits and motion pictures is proved practically beyond question —when the subject-matter is of the highest standard.

It may be of interest to note at this point that one of the subjects for research for which Chamberlain-Kahn funds have been allotted is to the department of psychology of a leading university to provide for the thorough investigation of the effect on various audiences which view them of moving pictures on subjects of social hygiene.

LEGISLATIVE ENACTMENTS

Legislative measures sincerely and unflinchingly enforced are at this time necessary in order to control the wilful and ignorant persons of the community who, themselves infected, will not take precautions to protect their neighbors. The right of the community to protect its health has long been recognized; and citations from various legal writers of unquestioned authority were made early in this campaign for the control of venereal diseases by the attorney general of the United States. Enforcement of sanitary measures should not create an issue with educational and moral appeal. The moral value of whatever will best safeguard the community at present, and therefore make for the best in posterity, cannot be questioned.

It is evident that no arbitrary grouping of these measures is attempted or possible. Medical effort is in the best sense educational. Education in this field includes medical and legislative information, and both are vitally social, in addition to the activities of a distinctively sociological nature, on which the permanent control of syphilis and gonorrhea, as of other communicable diseases, depends.

COMMUNITY AND COOPERATIVE EFFORT

The undertaking is a community undertaking. The individual physician cannot from his office follow all his cases of gonorrhea and syphilis to the successful termination which means control and prevention of disease. Nor can the health officer alone, even with his special administrative machinery, entirely meet the situation. There is needed opportunity to draw on the resources of the community and to take advantage of aroused public sentiment and civic loyalty in prosecution of this campaign, and the social agencies of the community have never been so alert to help intelligently or criticize acutely as they are found to be today.

That this is not theory, but an actual, practical possibility, finely demonstrated in the past two years, may be indicated even by mention of some of the various civilian groups in active cooperation with the service and the state boards of health. Employers of labor have responded to the program for introducing into their plants educational literature, and have established clinics—sometimes several firms in a small town uniting to meet the expense of the clinic.

Groups of working men and women have not only welcomed the literature and lectures in the industrial plants, but have also expressed through their official organizations appreciation and desire to cooperate. Chambers of commerce, rotary clubs, churches and church organizations, women's clubs, parent-teacher associations—these and many other groups in the community stand ready to serve by influence and active work or financial support.

When the work was first organized, an association of retail druggists, representing about 8,000 of the 47,000 retail druggists of the United States, offered its cooperation in this important work. A card was prepared, approved by the druggists' organization and mailed to pharmacists all over the United States by the

Public Health Service. This card contained an appeal to the druggists to support venereal disease control work by pledging themselves to discontinue the sale of venereal disease nostrums, and also by refusing to prescribe remedies for the self-treatment of venereal diseases. The response was gratifying. The druggists not only agreed to cooperate as they were asked to do, but also agreed to hand each customer who applied for a remedy ordinarily used in the self-treatment of venereal diseases, a circular advising the sufferer to seek competent professional service, either from a practicing physician or at a venereal clinic. In this plan approximately 32,000 druggists are now actively cooperating.

Perhaps this rapid résumé of the work of eleven months will at least suggest the year's progress, in its total accomplishment and in its direction.

THE PHYSICIAN'S PART

In closing this paper I desire to emphasize the peculiar relation to the future of the program which is borne inevitably by the physician himself. Into the hands of many of you has already come that recently published little volume, prepared for use in this campaign by Dr. J. H. Stokes of Rochester, entitled "Today's World Problem in Disease Prevention." In his preface Dr. Stokes says:

> It is no longer possible for the individual physician to maintain the isolation and the arbitrary powers and reponsibilities which were his in primitive times. . . . A partnership between intelligent and well informed public opinion and the physician as leader is the logical ultimate expression of the trend of the times. . . . The physician as a leader, acting alone, is helpless. . . . To make every intelligent man, woman and child a legionary in the organization of the public health, some of the knowledge so long sedulously kept as the property of the profession of medicine must be imparted to the rank and file.

The opportunity of the physician, the challenge to the physician, of this determined undertaking to control syphilis and gonorrhea is unmistakably evident.

Consider, for instance, the following truths: It is the physician who must teach the future physician. The demand for a higher grade of teaching in syphilology has been heard, not in this country alone; it has come from the medical profession of every country which, in the past four years, has borne the burdens of war.

It is the physician who must finally teach the people, whether in his own office or in the clinic consulting room, what they must know and do to control and prevent venereal disease. To no other person but a physician comes such an opportunity as that of the patient's first visit for offering enlightenment, for teaching a truth which shall endure and for impressing on him his responsibility toward his family and neighbors. In this task, personality, sincerity, skill and humanity are taxed for the remaking of the individual. Contact not only with the patient but with the patient's family, the social group and community means multiplying the physician's power to control disease. Physicians make, as it were, a system of social engineering, whereby breeding places of syphilis and gonorrhea may be drained, more easily than was supposed possible. The examination of the family of an infected person is not often refused when frankly and tactfully suggested by the physician. Very often it is even asked for by the patient.

This procedure leads yet farther. It means often the discovery of carriers, of sources of infection in the community, sources which the physician himself may not be able to control, but which becomes the concern of the health officer duly acquainted with them by the reports of the physician.

Again, it is the physician who after all reduces the number of "lost cases," always a clinic or dispensary problem. The patient who is treated simply as clinical material will naturally not desire to return for a second experience of the kind. But he will quickly discern the humanity of the man who treats him, the

human spirit of the institution to which he goes. Skill, prime essential though it be, is not alone enough to insure the full realization of a clinic's possibilities. Tribute to the men who have proved this true!

And it is again the physician who will maintain high professional standards of clinic and hospital. It was long ago whimsically remarked that the physician who helps develop the clinic is cutting his own financial throat; but this, of course, is untrue, and that a new view of clinic service prevails today is evident. The physician is asked to give much. There is also much for him to gain. Besides the rich opportunity for studying varied types in a clinic which receives, for instance, 1,000 venereal cases a month, there is to be gained also a knowledge of the peculiar social backgrounds of syphilis and gonorrhea. These must be known and reckoned with. On the control of social causes depends all permanent control of the diseases.

Finally, the physician may be assured that his participation in various phases of this limitless effort, scientific and social, will insure for him public support of an intelligent and appreciative type that is a thing unique today. Other national campaigns against tuberculosis, trachoma or hookworm disease, all have had social and economic complications of their own. But in the case of syphilis and gonorrhea there is added to these social and economic aspects of the problem the handicap of age-long false tradition. We face a very slowly yielding prejudice against even discussion of these matters. We face the difficulty of directing human wills and instincts. Such a demand on the physician, and on every intelligent member of society, would seem appalling were the possibilities not testified to by a remarkable demonstration of what has already been done.

Preventive medicine is one of the contributions to the world of the medical profession. To the medical profession the world, in this after-war day, turns in confidence for the solution of its deepest problem.

ABSTRACT OF DISCUSSION

DR. WILFRED H. KELLOGG, San Francisco: California was the first state in the field in this work. Owing to the fortunate existence of an emergency fund the governor was enabled to make an appropriation of $60,000. A bureau was organized and in operation as early as August, 1917. Its program was based on the usual classification or division of work into three principal parts, education, law enforcement and treatment. We might more accurately arrange these activities in a more extended manner, such as elimination of foci of infection, education, law enforcement, rehabilitation, prophylaxis and care of the feebleminded. Under the first heading will come the treatment of infected cases, quarantine, establishment of clinics and reporting of cases. Perhaps, under this heading should also come the division of rehabilitation, although this problem must be handled in an entirely separate and distinct manner. I refer to the rehabilitation measures capable of application to prostitutes, which it is possible by law enforcement measures to bring under the jurisdiction of the health department. The enforcement of law against prostitution is of extreme importance in controlling the spread of venereal diseases, and yet I feel that our best position is to take advantage, wherever possible, of activities of this sort in local communities by seeing to it that women taken up by the police are properly detained and treated, but not to be too closely related with the pushing of activities in this direction. I think we should greatly favor law enforcement, but it would be a mistake to be associated too intimately with organizations which are related exclusively to the moral side of the problem.

Prevention of infection by prophylactic treatments in civilian communities is very difficult to carry out, and it is this reason rather than the moral objections that are brought against it that should weigh in the decision as to whether or not it is to be added to our list of activities.

DR. A. E. CHASE, Texarkana, Ark.: I find that the railway employee is, perhaps, unusually exposed to venereal infection, because of his mode of life and because of his being away from home a great deal. When I took charge of the health and welfare of many thousands of these men, I felt it a duty to open a venereal campaign, on two lines. The U. S. Public Health Service helped us out wonderfully. On the educational line, I ran up against a stumbling block. A committee was appointed by the Railroad Administration and informed me that this educational campaign should not be carried on, because they had been ordered by their superior officers not to carry on the campaign among railway employees because the unions would be peeved by such a procedure and labor troubles would result. I am sure that those who originated that order did not understand the railway employee,

because I have met many thousands of them in talking over this program, and as a result I have not only got them to endorse this campaign, but they have asked that additional means be taken to carry on the campaign, and that amounts be withheld from their monthly salary to carry on the work. It shows that the railroad employee is a man, and that he understands his own faults and that he is willing to do all he can to promote health conditions himself. He is not a man who is unusually touched by that class of educational propaganda. On the medical side there is a very difficult question. This class of cases is very hard to handle. The prophylaxis side of the question is the most important, and I hope that the U. S. P. H. Service will help us arrange stations not only for railroad men, but for all others who need this service.

DR. FRANKLIN L. GRAM, Buffalo: I would like to ask Dr. Pierce whether he would advise us to keep records and reports of these cases by serial numbers. We have been carrying out a venereal program for the past eight years in Buffalo; we have a clinic and a hospital for the treatment of the disease; we give arsphenamin free; we give examinations free, and we help in every way along the prophylactic and curative line. After an actual experience of eight years, I can say that we would be swamped if we were to conduct our work by serial numbers. We record the real names and real addresses, but the records are confidential, the same as we carry our tuberculosis records. We had the same trouble originally with tuberculosis records, but by keeping them confidential and letting the public know that they were confidental, we succeeded in getting all the facts. We also work together with the police and courts.

There is another matter of very great importance, namely, maliciousness. I had a report recently, made by telephone, of a young lady who was accused of spreading venereal infection. Investigation and examinations showed that she was innocent and the accusation malicious. I fail to see how we are going to control venereal disease or make any progress in that direction, with all due respect to the federal and state government, by reporting and recording cases by serial numbers.

DR. I. D. RAWLINGS, Chicago: In Chicago we receive the report without the name or address of the patient and we find that it works out very well. We have in our ordinance a provision that the physician must report in this manner, and if the patient discontinues treatment, then it is the duty of the physician to furnish the office with the name and address of the patient. We then look up that patient and require him to get under treatment with some physician, or if he is not able to pay, he must go to the clinic and take treatment. I do not see but what this method works out as

well as any other would. In the report of the case, we also get the data as to where he contracted the infection, so that point is covered by our method equally as well as if we had the name and address of the patient. Under all plans of reports the patient is apt to give a false name or a wrong address or both. One thing that I hope I will get out of this discussion that will help us in our work is how to induce the patient to give the physician his true name and his correct address, so that if the patient discontinues treatment and the name and address of the patient as given to the doctor is sent by the physician to the health department, we can locate him without difficulty. The patient can give a false address under any system, and you do not discover it until you try to locate him. These people cannot always be located. That is the chief trouble we are having in Chicago, and I do not see how we can remedy this difficulty by either system. Venereal disease patients will give a wrong address to their physician, and the result is that the health authorities are unable to act as they should.

DR. C. C. PIERCE, Washington, D. C.: Dr. Kellogg mentioned the place of prophylaxis in part of his program for venereal disease control. The Public Health Service believes that in the clinics prophylactic or early treatment should be given to those who apply. We do not, however, believe in the establishment of prophylactic stations as such, similar to those organized and maintained during the progress of the war, for several reasons. One is that you cannot conduct such a station properly without causing a great deal of antagonism on the part of certain groups of society, and another is that you have no control over persons who take the prophylaxis, as was the case in the army. In regard to Dr. Chase's statement that some railroad officials had told him not to carry on an educational campaign among unions—that is a very remarkable statement, because the Railroad Administration is very much in favor of his program. Practically all of the labor unions have welcomed most heartily the introduction of educational methods and are helping to carry on themselves. With regard to patients not staying under treatment: That is one of the results to be accomplished by the reporting of venereal diseases.

In regard to reporting by serial number or by name: That is left entirely to the local health authorities to choose the method they think gives the best results, and that is the only way it can be done. All data giving the sort of information which is of use to the health officer can be secured by either system of reporting. Health officers and government officials and others must not feel that they must conduct this campaign in all its details by themselves, but that they should utilize the present great desire on the part of all persons in the United States to do something to increase

the efficiency of our country. The central controlling agency in the venereal disease program is the state board of health, but we can utilize existing agencies in all parts of the country, and they will be of great material assistance to the state board of health or the city board of health in carrying out a comprehensive program for the prevention of venereal disease. A very important phase is controlling the carrier and treating those who are already infected because in no other way can venereal diseases be prevented.

OPEN AIR CLASSES

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The Bureau of Child Hygiene of the department of health of New York City conducts only activities of preventive medicine. These activities cover a period of the child's life from the prenatal state until the completion of the elementary school. The activities are controlled by definite divisions of the bureau to cover various periods of life, as well as special activities. The division of baby welfare supervises the prenatal work and care of the infant from birth until the second year is reached. The division of midwives and foundlings issues permits to midwives and supervises their methods in carrying on their practice. It also issues permits for the privilege of keeping foundlings, and supervises the care they receive. The division of school medical inspection conducts a progressive campaign of preventive medicine throughout the year, both in the schools and in the homes of the pupils. The division of employment certificates issues certificates only to schoolchildren of correct age who are in physical condition to work. There is a division of eye clinics and a division of dental clinics which conduct their special branches of medicine exclusively for the benefit of schoolchildren.

The preschool age of the child, that is, from the second year until the child's entrance into school, is not systematically supervised. Some pioneer work has been done by our bureau, and the necessity and value of it have been conclusively proved. This period of

the child's life can no longer be neglected, and one of the next steps in public health and preventive medicine will be the giving of more attention to it.

One of the activities of the division of school medical inspection is the medical supervision of the open air classes of the public schools. The pedagogic work of these classes is conducted entirely by the board of education.

The classes were organized to provide special opportunities for the physically subnormal pupils, after an experiment had been conducted in one class to ascertain the value of such organization. The results have been so gratifying that there are now 110 open air classes. The classes are at present located on the roofs of the school buildings, roofs of auditoriums, in public parks and in the school buildings.

Our experience has proved that in a large city these classes are best placed in the school building, in a classroom properly located and with the required structural changes. Besides, it is difficult to protect them from the rain, snow, direct sunlight and dust. Roofs require the climbing of too many stairs. Locations in the parks would be ideal were it not for the expense of the structures required. Besides, in our city, the parks available are so inadequate that only a small number of classes can be located in them. When the original school building is being constructed, very little additional cost is added by providing one or more open air classrooms. The board of education now provides at least one open air classroom in every new school building.

At present the following types of children are admitted to the open air classes:

1. Children exposed to tuberculosis at home, or in whose family there has been a recent death from this disease.
2. Children who have had tuberculosis which is now arrested or cured.
3. Children suffering from malnutrition.

4. Children who become tired easily or show languor or fatigue before the end of the day, and on this account are unable to carry on their class work.

5. Children suffering from nervous diseases except chorea.

6. Children who frequently are absent because of colds, bronchitis, etc.

7. Children suffering from cardiac disease, who are recommended by the private physician as pupils who ought to be put in these classes.

The classification provides for the tuberculous, pretuberculous and physically subnormal children who may be benefited by becoming pupils in one of these classes.

The regular equipment for open air classes consists of individual school study chairs, cots and sleeping bags. The study chairs are easily movable, and groups of any of the children can be formed for the convenience of the teacher. The children use their sleeping bags when sitting in their study chairs or lying on their cots.

The important factors in the success of this work are fresh cool air, light, food, correction of physical defects that retard growth and development, and proper hygienic living conditions. These are all provided for during the school session. But it must be borne in mind that the children are in school only five hours a day on school days and that we have about 190 school days a year.

During the school hours, the children are completely under control and receive the care they require. The classrooms have ample light and air, as they are always located where these can be provided. Our choice is always a southern and eastern exposure when these are procurable. We have found that the cold air is a decided advantage and that no temperature is too low, provided the children are properly protected by their clothing and their sleeping bags. The greatest increase in weight is always made during the colder weather. With the first return of warm weather, the

increase of weight is retarded. This is, to a great extent, because of the influence of the temperature on the appetites of these children. Their appetites are always better in colder weather.

Food is one of the essentials for children of these types, and we have found that three meals a day are not sufficient to assist them to a normal average weight. Extra feeding is always provided between breakfast and lunch and, as far as possible, between lunch and supper. This extra food is absolutely required by the children during the colder weather, and they all anxiously await it. Milk and bread and butter are the best foods for them; but our funds, which all come from private sources, have been limited, and for the past year and a half we have had to rely on cereals and milk. All classrooms located in new buildings, as well as many in the old ones, have a separate kitchen in which to prepare the food.

The children whose growth and development has been retarded because of physical defects, such as adenoids, hypertrophied tonsils and carious teeth, respond very quickly after their defects are properly remedied. Though they would in most cases improve in regular classes after correction of their defects, the improvement is more rapid when they have the advantages provided in the open air classes. Nearly all of these children having physical defects improve while in these classes, but return to their previous condition rapidly if sent back to a regular class.

In school, the children have frequent short recesses for recreation. They have a rest period of one hour before lunch, during which time all children lie on their cots. Some learn to sleep during this period, but many merely rest. The daily routine followed in an open air class (Table 1) divides the day into three periods: two hours for school work, two hours for rest and lunch and, again, two hours for school work. We have the long rest period before lunch, as we have

found that if we stop the school work after two hours to give the children a long rest, they do not become overfatigued. They recuperate rapidly, and by lunch time are fully back to their normal condition; and, furthermore, not being fatigued, they have good appetites, and derive the benefits which accrue from eating large meals.

Classes that are located on the upper floors have a rest period from 1 to 1:10 p. m. also. The time is deducted from the morning period of rest, and is given to afford the children a short rest after climbing so many stairs.

Parents are instructed to have their children rest at home before supper, and they are also urged to continue the morning extra feeding and to see that the children rest during the usual time on those days when the school is not in session.

The most difficult problem we have to contend with in a large city is that of the hygienic conditions at home. They entail a great deal of social service work, which, however, our teachers and nurses willingly do. This work may appear foreign to the subject, but it cannot be neglected, for all the results gained in school will avail nothing unless the home conditions are properly corrected.

From our present experience, I believe that the factors already enumerated are the important ones, and none of them can be slighted if success is to be our goal.

MEDICAL ATTENTION AND TEACHERS

The classes are visited daily by the school nurses of the health department. Their duties are definitely defined, and they work in cooperation with the medical inspectors and the teachers. The medical inspectors of the health department have full medical charge of these classes. They admit and discharge pupils, make regular systematic physical examinations of all pupils, and repeat the examination in any individual case as

often as the child may require it. All the work of the nurses and inspectors in the classes and in the homes of the pupils is recorded on individual record cards for each pupil.

The medical inspectors decide the extent of physical exercise in which each pupil is permitted to participate. The department of physical training of the board of education supervises the exercises and play, and regulates them for each pupil according to the limitations ordered by the medical inspectors.

The scholastic work is entirely under the supervision of the board of education. The classes are limited to a registration of twenty-five pupils. As these pupils

TABLE 1.—DAILY ROUTINE OF AN OPEN AIR CLASS

9:00 to 10:00 a. m.	School Work
10:00 to 10:15 a. m.	Extra feeding
10:15 to 11:00 a. m.	School work
11:00 to 12:00 noon	Rest period
12:00 to 1.00 p. m.	Lunch period
1:00 to 2:45 p. m.	School work
2:45 to 3:00 p. m.	Second extra feeding

are usually in various grades, the group method of teaching is used. Only essential subjects can be taught.

Teachers of open air classes are specialists, and only those filling the required qualifications are selected. The qualifications considered essential are: good health; even temperament; capacity for doing a large amount of school work well, as a number of grades must be taught; physical ability to make home visits; tact in handling both children and parents; willingness to do social service, and a desire to study the problems of this work in the class by reading and taking an appropriate study course.

A poor teacher, or one not physically strong, is a great handicap to an open air class, as the success of the work rests to a great extent on her.

RECORD OF PUPILS

Children who are transferred from the open air class to a regular class are seen at least once a month by the nurse, who keeps a record of their condition, weight and scholastic standing. Of 506 children transferred, 367 were followed up, with the results observed in Table 2.

TABLE 2.—CASES DISCHARGED FROM OPEN AIR CLASSES

Gained Weight	Remained Same	Lost	Scholarship Improved	Same	Worse
319	43	5	70	292	5

The effects on all pupils in the open air classes are shown in Table 3.

TABLE 3.—PROGRESS OF ALL PUPILS IN OPEN AIR CLASSES

Gained More Than Average	Average Gain	Less Than Average	Scholarship Improved	Same	Worse
2,131	796	79	718	2,198	90

Those children who failed to gain in weight were suffering from physical defects of such marked character that it is most reasonable to attribute their failure to gain to this known cause. The children who failed at least to maintain their regular scholastic standings are mental defectives, as their previous records show. These children ought not be placed in open air classes, as it is impossible to give them there the attention they demand.

We have one open air class with pupils of the usual average physical condition. This class has been conducted by the same teacher for five years, and the pupils, all boys, are in one of the grades of the last two years of the elementary school. It is a regular class placed in an open air classroom. All the work of their grade is covered. They have no cots, and only short recesses without a rest period. They do receive

the morning extra feeding. They do their drawing and shop work in a regular classroom during the cold weather. All the rest of their school work is done in their own room, which is always at the temperature of the outside air. This class has a registration of forty-five pupils.

The observations made during the past five years, of ten separate classes, fully demonstrate many facts which are all proved by the records of the various classes. These results can be best summed up by drawing a comparison between the scholastic and physical records maintained in the open air classrooms and those in the regular classrooms of the same grades, as shown in Table 4.

TABLE 4.—STANDARDS IN OPEN AIR CLASS ROOM AS COMPARED WITH THOSE IN REGULAR CLASS ROOMS

	Pupils	Teacher
Scholastic Record	Work: Full work or more. Penmanship: Satisfactory. Application: Better ..... Progress: More rapid.... Effort: Increased ..... Written work: Not handicapped. Absences: Decreased .... Sickness: Lessened ..... Promotions: Higher Average. Less home work required.	Easier to get results. Less mental tax. Can cover more than prescribed course in assigned time.
Physical Record	More active and responsive to work. Display ability and willingness to do more. Show an increase in weight more than the average gain. Show no fatigue from scholastic work.	Physical condition easily maintained. No loss of weight. Absences less. Daily fatigue not appreciable.

The improvement in the physically subnormal children in open air classes over those in regular classes is now a well established fact, and the only handicap is the number of such classes necessary. A great many more are required than are now provided for; but we

are unable to use many more classrooms for only twenty-five pupils while there are so many part time classes in existence in our city. The open air classroom is still an experiment and must remain so until we have ample school buildings to permit the organization of as many open air classes as are required.

OPEN AIR CLASS WORK FOR ALL PUPILS

Our experiment with a regular class in an open air classroom opens up another field, however; now that there is such an active campaign to improve the physical condition of the nation, there appears to us no better way to effect the improvement than by extending the use of the open air classroom to every schoolchild. If the routine can do so much for the subnormal, is it not natural to expect at least as much for the average child? To change to open air class work would naturally entail a marked reform in our school buildings and could not be immediately put into operation. But we do look forward to the time when we will strive to raise a hardy race and not hothouse plants. A building properly constructed would require no heat in any other classrooms than those used for manual work, such as shop work, designing, cooking, etc., provided the children were properly equipped to be protected from low temperatures. Such a step would be a great progress in preventive medicine. Any one who has the opportunity of visiting a regular and an open air classroom during the winter can readily decide for himself which one is conducive to growth, development and health. We look forward to the time, not far off, when we shall be able to conduct an entire school of normal children as an open air class school.

RESULTS

From the observations made so far, these results of open air class work can be enumerated:

1. Physically subnormal children improve in their mental and physical condition.

2. Their nutrition and weight improve.

3. The gain, in most instances, will be permanent.

4. In arrested cases of tuberculosis there are no relapses.

5. The nervous system is restored to a normal condition.

6. In cardiac cases pupils kept under proper medical supervision improve markedly.

7. The capacity for doing work is increased and brought to at least a normal average.

8. Absence from school on account of illness is greatly reduced.

9. A proper diet is followed, and the food is properly prepared.

10. Good habits are established.

11. Hygienic rules are lived up to.

12. Children learn how to do the right things at the right time.

It is our firm belief that average children will give even better results if afforded the same opportunities.[1]

ABSTRACT OF DISCUSSION

Miss Annie Morrison, Grand Rapids, Mich.: I find that the dangers with the ungraded rooms are often greater than the dangers with the normal children in the realm of education. As to the personal guidance, when the abnormal children reach the age at which they go to work, between 14 and 16, is there any vocational guidance in New York for these children? We find that when the child in the ungraded room of the open air school leaves the school and goes to work, it ought to be guided, because it is not fitted bodily for the average work which is required of a physically fit laboring man or woman. Then, again, is any study given to the kind of work that the child afflicted with tuberculosis should be engaged in after the school age.

1. A detailed account of the method of conducting open air classes of New York City appeared in the Monthly Bulletin of the Department of Health, City of New York, October, 1918.

EXPERIMENTS TO DETERMINE MODE OF SPREAD OF INFLUENZA

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BOSTON

The experiments here described were performed on an island in Boston Harbor, on volunteers obtained from the Navy. The work was conducted by a group of officers detailed for that purpose, from the U. S. Navy and the U. S. Public Health Service, consisting of Dr. G. W. McCoy, director of the Hygienic Library, Dr. Joseph Goldberger, Dr. Leake, and Dr. Lake, all on the part of the U. S. Public Health Service; and cooperating with those medical officers, was a group also detailed for this purpose on the part of the U. S. Navy, consisting of Dr. J. J. Keegan, Dr. De Wayne Richey and myself.

The work itself was conducted at Gallops Island, which is the quarantine station of the Port of Boston, and peculiarly well fitted for operations of this kind, serving adequately for the purposes of isolation, observations, and maintenance of the large group of volunteers and personnel necessary to take care of them.

The volunteers were all of the most susceptible age, mostly between 18 and 25, only a few of them around 30 years old; and all were in good physical condition. None of these volunteers, 100 all told in number, had "influenza;" that is, from the most careful histories that we could elicit, they gave no account of a febrile attack of any kind during the winter, except a few who were purposely selected, as having shown a typical attack of influenza, in order to test questions of immunity, and for the purpose of control.

Now, we proceeded rather cautiously at first by administering a pure culture of bacillus of influenza, Pfeiffer's bacillus, in a rather moderate amount, into the nostrils of a few of these volunteers.

These early experiments I will not stop to relate, but I will go at once to what I may call our Experiment 1.

EXPERIMENTS AT GALLOPS ISLAND

As the preliminary trials proved negative, we became bolder, and selecting nineteen of our volunteers, gave each one of them a very large quantity of a mixture of thirteen different strains of the Pfeiffer bacillus, some of them obtained recently from the lungs at necropsy; others were subcultures of varying age, and each of the thirteen had, of course, a different history. Suspensions of these organisms were sprayed with an atomizer into the nose and into the eyes, and back into the throat, while the volunteers were breathing in. We used some billions of these organisms, according to our estimated counts, on each one of the volunteers, but none of them took sick.

Then we proceeded to transfer the virus obtained from cases of the disease; that is, we collected the material and mucous secretions of the mouth and nose and throat and bronchi from cases of the disease and transferred this to our volunteers. We always obtained this material in the same way: The patient with fever, in bed, has a large, shallow, traylike arrangement before him or her, and we washed out one nostril with some sterile salt solution, using perhaps 5 c.c., which is allowed to run into this tray; and that nostril is blown vigorously into the tray. This is repeated with the other nostril. The patient then gargles with some of the solution. Next we obtain some bronchial mucus through coughing, and then we swab the mucous surface of each nares and also the mucous membrane of the throat. We place these swabs with the material in a bottle with glass beads, and add all the material obtained in the tray. This is

the stuff we transfer to our volunteers. In this particular experiment, in which we used ten volunteers, each of them received a comparatively small quantity of this, about 1 c.c. sprayed into each nostril and into the throat, while inspiring, and on the eye. None of these took sick. Some of the same material was filtered and instilled into other volunteers but produced no results.

Now, I may mention at this point that the donors were all patients with influenza in Boston hospitals; sometimes at the U. S. Naval Hospital at Chelsea, sometimes at the Peter Bent Brigham Hospital, where we had access to suitable cases. We always kept in mind the fact that we have no criterion of influenza; therefore I would like to emphasize the fact that we never took an isolated case of fever, but selected our donors from a distinct focus or outbreak of the disease, sometimes an epidemic in a school with 100 cases, from which we would select four or five typical cases, in order to prevent mistakes in diagnosis of influenza.

Now, thinking that perhaps the failure to reproduce the disease in the experiments that I have described was due to the fact that we obtained the material in the hospitals in Boston, and then took it down the bay to Gallops Island, which sometimes required four hours before our volunteers received the material, and believing that the virus was perhaps very frail, and could not stand this exposure, we planned another experiment, in which we obtained a large amount of material, and by special arrangements, rushed it down to Gallops Island; so that the interval between taking the material from the donors and giving it to our volunteers was only one hour and forty minutes, all told. Each one of these volunteers in this experiment, ten in number, received 6 c.c. of the mixed stuff that I have described. They received it into each nostril; received it in the throat, and on the eye; and when you think that 6 c.c. in all was used, you will

understand that some of it was swallowed. None of them took sick.

Then, thinking perhaps it was not only the time that was causing our failures, but also the salt solution —for it is possible that the salt solution might be inimical to the virus—we planned another experiment, to eliminate both the time factor and the salt solution, and all other outside influences. In this experiment we had little cotton swabs on the end of sticks, and we transferred the material directly from nose to nose and from throat to throat, using a West tube for the throat culture, so as to get the material not only from the tonsils, but also from the posterior nasopharynx.

We used nineteen volunteers for this experiment, and it was during the time of the outbreak, when we had a choice of many donors. A few of the donors were in the first day of the disease. Others were in the second or third day of the disease. None of these volunteers who received the material thus directly transferred from cases took sick in any way. When I say none of them took sick in any way, I mean that after receiving the material they were then isolated on Gallops Island. Their temperature was taken three times a day and carefully examined, of course, and under constant medical supervision they were held for one full week before they were released, and perhaps used again for some other experiment. All of the volunteers received at least two, and some of them three "shots" as they expressed it.

Our next experiment consisted in injections of blood. We took five donors, five cases of influenza in the febrile stage, some of them again quite early in the disease. We drew 20 c.c. from the arm vein of each, making a total of 100 c.c., which was mixed and treated with 1 per cent. of sodium citrate. Ten c.c. of the citrated whole blood were injected into each of the ten volunteers. None of them took sick in any way. Then we collected a lot of mucous material from the upper respiratory tract, and filtered it through Man-

dler filters. While these filters will hold back the bacteria of ordinary size, they will allow "ultramicroscopic" organisms to pass. This filtrate was injected into ten volunteers, each one receiving 3.5 c.c. subcutaneously, and none of these took sick in any way.

The next experiment was designed to imitate the natural way in which influenza spreads, at least the way in which we believe influenza spreads, and I have no doubt it does—by human contact. This experiment consisted in bringing ten of our volunteers from Gallops Island to the U. S. Naval Hospital at Chelsea, into a ward having thirty beds, all filled with influenza.

We had previously selected ten of these patients to be the donors; and now, if you will follow me with one of our volunteers in this ward, and remember that the other nine were at the same time doing the same thing, we shall have a picture of just what was happening in this experiment:

The volunteer was led up to the bedside of the patient; he was introduced. He sat down alongside the bed of the patient. They shook hands, and by instructions, he got as close as he conveniently could, and they talked for five minutes. At the end of the five minutes, the patient breathed out as hard as he could, while the volunteer, muzzle to muzzle (in accordance with his instructions, about 2 inches between the two), received this expired breath, and at the same time was breathing in as the patient breathed out. This they repeated five times, and they did it fairly faithfully in almost all of the instances.

After they had done this for five times, the patient coughed directly into the face of the volunteer, face to face, five different times.

I may say that the volunteers were perfectly splendid about carrying out the technic of these experiments. They did it with a high idealism. They were inspired with the thought that they might help others. They went through the program in a splendid spirit. After our volunteer had had this sort of contact with the patient, talking and chatting and shaking hands with him for five minutes, and receiving his breath five times, and then his cough five times directly in his face, he moved to the next patient whom we had selected, and repeated this, and so on, until this volunteer had had that sort of contact with ten different cases of influenza, in different stages of the disease, mostly fresh cases, none of them more than three days old.

We will remember that each one of the ten volunteers had that sort of intimate contact with each one of the ten different influenza patients. They were watched carefully for seven days—and none of them took sick in any way.

EXPERIMENTS AT PORTSMOUTH

At that point, the holidays came, our material was exhausted, and we temporarily suspended our work. In fact, we felt rather surprised and somewhat perplexed, and were not sure as to the next way to turn, and we felt it would be better to take a little breathing spell and a rest.

We started another set of experiments in February that lasted into March, again using fifty volunteers carefully selected from the Deer Island Naval Training Station. These experiments I will not give in detail. They would take too long. They were simply designed and the program was carefully planned, but the way matters turned out became very confusing and perplexing. I will give two instances to explain what I mean by that; and I give them because they are exceedingly instructive and very interesting.

In February and March, the epidemic was on the wane. We had difficulty in finding donors. We were not sure of our diagnosis, having no criterion of influenza. We therefore felt very fortunate when we learned of an outbreak that was taking place at the Portsmouth Naval Prison, only a few hours north of Boston. We at once loaded a couple of automobiles filled with our volunteers, and rushed up to Portsmouth, and there repeated many things that I have described in our first set of experiments. At Portsmouth, out of a large number of cases, we made our selections carefully, taking the typical cases for donors, and transferring the material directly to our volunteers. In about thirty-six hours, half of the number we exposed came down with fever and sore throat, with hemolytic streptococci present, and doubtless as

the causal agent. All the clinicians who saw these cases in consultation agreed with us that they were ordinary cases of sore throat.

Another incident: One of our officers, Dr. L., who had been in intimate contact with the disease from early in October, collected material from six healthy men at the Portsmouth Navy Yard who were thought might be in the period of incubation of the disease—we were trying to get material as early as possible, because all the evidence seems to indicate that the infection is transmittable early in the disease. None of the six men came down with influenza, but Dr. L. came down in thirty-six hours, with a clinical attack of influenza, although he had escaped all the rest of the outbreak.

CONCLUSION

I think we must be very careful not to draw any positive conclusions from negative results of this kind. Many factors must be considered. Our volunteers may not have been susceptible. They may have been immune. They had been exposed as all the rest of the people had been exposed to the disease, although they gave no clinical history of an attack.

Dr. McCoy, who with Dr. Richey, did a similar series of experiments on Goat Island, San Francisco, used volunteers who, so far as known, had not been exposed to the outbreak at all, also had negative results, that is, they were unable to reproduce the disease. Perhaps there are factors, or a factor, in the transmission of influenza that we do not know.

As a matter of fact, we entered the outbreak with a notion that we knew the cause of the disease, and were quite sure we knew how it was transmitted from person to person. Perhaps, if we have learned anything, it is that we are not quite sure what we know about the disease.

[A complete account of the experiment is being published by the U. S. Public Health Service.]

THE EPIDEMIOLOGY OF INFLUENZA

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The history of influenza so far as it is known, that is, for several centuries, comprises a series of long cycles in which great pandemics alternate with periods of relative quiescence, the length of cycles as measured by the intervals between pandemics being usually a matter of decades. The special characteristics of influenza pandemics are their wide and rapid extension, their high attack rates, and great effect on general mortality rates. Since these cycles are undoubtedly of fundamental significance in the natural history of influenza any proper discussion of the epidemiology of the disease should cover at least one full cycle, preferably the last, from 1889 to the present. The material for such a discussion must, however, be collected from many and diverse sources and laboriously fitted together, since there is no concrete specific and continuous record of the prevalence or mortality of influenza during such a period of years.

LACK OF SPECIFIC RECORDS

During great epidemics there are abundant, if not exact records of prevalence, and the resulting mortality can be determined with fair precision, even though a large proportion of the deaths are classified under diagnoses other than influenza. In the intervals between epidemics influenza becomes inextricably confused with other respiratory diseases, having a general clinical resemblance but no definite etiologic entity, so that the

record of prevalence and even of mortality is virtually lost. The first requisites for epidemiologic study; namely, clear differential diagnosis and systematic records of occurrence, are therefore lacking in influenza.

In the absence of these essential records, statistics of mortality from the group comprising influenza and all forms of pneumonia afford, perhaps, the nearest approximation to a record of influenza. It is not intended to suggest that the mortality from this group of diseases furnishes in any sense a *measure* of the prevalence of influenza, but only that it furnishes an *index,* since it is well established that the epidemic prevalence of influenza markedly affects the mortality from this group of diseases, and since it is at least probable that, even in nonepidemic periods, there may be some intimate and constant relation between the prevalence of influenza and the mortality from pneumonia.

The following discussion, which is necessarily confined to a few broad outlines, is accordingly based on records of mortality from influenza and pneumonia for a series of years; statistics of general mortality during the recent epidemic, and limited morbidity statistics.

INFLUENZA AND PNEUMONIA MORTALITY IN MASSACHUSETTS, 1887-1916

Table 1 and Chart 1 show for Massachusetts, a state in which continuous records are available, the number of deaths and the death rates per hundred thousand from influenza and from all forms of pneumonia, by months, from 1887 to 1916, inclusive.

Chart 1 shows clearly the effect of the epidemic of 1889-1892, developing in three distinct phases, the first phase culminating in January, 1890; the second in April and May, 1891; and the third in January, 1892. It will be noted that the mortality was higher in 1891 than in 1890, still higher in 1892, and that in 1893, although no distinct epidemic occurred, the pneumonia mortality for the year was still higher than in 1892.

TABLE 1.—DEATH RATES PER HUNDRED THOUSAND OF POPULATION, FROM PNEUMONIA (ALL FORMS) AND FROM INFLUENZA, IN MASSACHUSETTS, 1887–1916, INCLUSIVE

Year	Total Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
						PNEUMONIA							
1887	159.0	19.5	16.7	1.9	22.6	16.1	7.7	5.5	4.1	5.6	9.0	14.8	15.3
1888	172.7	24.7	25.1	26.4	21.3	16.4	8.0	5.5	4.0	6.2	11.4	9.8	13.9
1889	156.6	17.9	16.3	21.1	19.8	14.9	7.5	5.3	5.2	5.4	10.6	13.2	19.3
1890	180.0	47.8	17.7	17.6	20.1	12.7	8.5	6.2	4.8	5.0	9.4	11.8	18.3
1891	188.5	20.6	16.4	20.6	25.1	23.9	10.1	5.9	4.0	4.0	7.7	13.8	36.4
1892	213.0	61.5	25.2	23.1	21.4	17.0	8.3	5.4	4.2	6.8	8.5	12.5	19.0
1893	225.8	27.3	25.4	28.6	33.1	27.3	11.1	8.0	5.0	6.1	9.8	14.3	31.9
1894	166.0	32.8	19.9	22.7	18.5	14.0	8.5	5.1	5.1	6.8	8.2	11.3	13.6
1895	184.1	19.1	34.4	30.8	20.9	14.4	7.6	5.6	5.3	4.7	10.5	13.4	17.3
1896	182.0	19.5	20.7	24.9	25.9	18.7	10.3	7.6	4.5	7.6	10.7	12.7	18.8
1897	181.6	21.1	24.9	31.5	19.7	15.2	10.2	7.0	4.5	6.0	11.7	13.1	16.9
1898	156.0	18.8	17.1	18.5	18.7	15.7	6.6	6.0	4.8	5.6	10.6	12.8	21.0
1899	181.3	37.5	25.8	20.6	18.4	14.0	8.9	5.0	4.8	5.8	8.2	13.2	19.0
1900	188.3	22.7	21.1	42.0	30.5	17.6	8.7	5.3	4.3	5.3	6.2	9.9	14.7
1901	167.7	22.6	26.6	26.2	19.9	13.9	7.7	3.4	3.4	5.7	9.1	14.2	15.1
1902	158.9	15.7	18.9	19.9	16.8	15.5	8.0	6.2	5.3	5.7	11.8	14.5	20.6
1903	172.5	25.2	25.8	25.4	18.1	16.8	8.2	7.0	4.5	4.6	7.7	13.3	18.9
1904	172.1	22.6	22.7	24.1	21.2	14.2	6.7	5.9	4.4	6.5	9.4	15.0	19.5
1905	178.3	24.7	27.7	23.6	17.1	15.5	8.5	5.4	4.8	6.2	8.9	15.8	20.0
1906	174.1	22.5	21.9	24.1	21.7	14.9	5.1	6.2	5.0	6.0	9.4	13.8	21.0
1907	180.4	25.5	24.4	23.4	18.3	14.3	9.5	5.1	5.1	7.1	9.3	12.7	26.9
1908	165.8	26.6	22.2	21.1	19.4	13.5	6.6	4.9	5.8	6.4	9.2	12.4	17.6
1909	170.3	22.1	20.0	26.1	20.1	16.0	9.7	5.1	5.0	5.4	8.9	13.6	18.3
1910	197.6	24.1	20.7	27.5	23.3	16.9	9.7	7.3	6.3	9.1	12.3	17.0	23.6
1911	174.4	22.6	27.1	23.9	20.2	16.9	7.2	6.7	6.1	6.7	9.0	11.8	16.2
1912	152.0	19.8	20.2	21.2	16.4	13.3	6.2	5.0	4.1	5.8	9.5	10.5	19.9
1913	172.2	23.5	22.8	24.9	19.3	17.1	10.7	6.2	5.4	6.7	8.3	10.4	16.8
1914	166.0	22.9	20.1	23.2	20.4	15.2	8.2	5.1	5.5	6.0	10.1	12.6	16.8
1915	176.0	17.8	19.3	28.5	27.7	13.6	6.6	7.1	5.8	6.0	8.8	9.8	22.1
1916	176.6	35.6	25.5	23.0	17.3	14.0	7.4	5.3	4.1	5.9	7.6	12.8	18.3
						INFLUENZA							
1887	0.90	0.05	0.14	0.28	0.14	0.05	....	....	....	0.05	0.10	0.05	0.05
1888	0.51	0.14	0.05	0.05	....	0.05	....	....	....	0.05	0.14	....	0.05
1889	1.23	0.09	0.09	0.14	0.14	0.05	0.05	0.05	....	....	0.09	....	0.55
1890	18.31	10.96	2.90	1.43	0.94	0.40	0.36	0.22	0.04	0.18	0.22	0.27	0.40
1891	23.74	0.39	0.39	1.00	3.87	4.65	1.57	0.52	0.52	0.52	0.22	0.26	10.08
1892	41.06	24.33	7.64	3.02	1.33	1.10	0.72	0.51	0.17	0.21	0.33	0.68	0.47
1893	12.27	0.58	0.70	1.20	2.57	2.07	0.46	0.17	0.12	0.04	....	0.46	3.90
1894	14.97	7.41	3.16	1.38	1.09	0.40	0.20	0.16	0.08	0.16	0.20	0.16	0.36
1895	18.10	0.79	4.50	6.97	3.29	1.11	0.36	0.24	0.08	0.08	0.04	0.24	0.36
1896	5.81	0.93	0.62	1.16	1.05	0.46	0.39	0.15	0.12	0.04	0.27	0.19	0.43
1897	14.40	0.83	2.42	5.68	2.50	1.02	0.27	0.15	0.23	0.15	0.27	0.27	0.61
1898	8.56	0.59	0.59	1.56	1.30	1.48	0.37	0.11	0.22	0.07	0.19	0.26	1.32
1899	20.72	9.34	5.81	2.18	1.05	0.51	0.29	0.07	0.04	0.07	0.33	0.18	0.34
1900	25.27	1.21	1.50	9.20	9.23	1.85	0.68	0.21	0.07	0.11	0.11	0.32	0.78
1901	18.94	4.32	6.36	4.08	1.51	0.84	0.46	0.14	0.04	0.21	0.18	0.25	0.77
1902	5.89	0.59	0.87	0.90	0.69	0.73	0.24	0.21	0.14	0.03	0.24	0.45	0.80
1903	12.65	1.57	3.08	3.66	1.61	0.82	0.38	0.14	0.10	0.08	0.21	0.34	0.72
1904	10.26	1.45	2.06	2.80	1.38	0.78	0.27	0.20	0.07	0.10	0.17	0.34	0.64
1905	14.69	2.75	4.58	3.48	1.76	0.86	0.30	0.07	0.07	0.03	0.08	0.20	0.56
1906	6.57	1.13	1.07	1.29	0.78	0.36	0.06	0.19	0.13	0.06	0.16	0.16	1.17
1907	16.13	3.61	3.48	2.28	1.04	0.70	0.22	0.08	0.08	0.08	0.19	0.54	3.99
1908	10.42	4.48	2.10	1.51	0.86	0.31	0.12	0.06	0.08	0.19	0.15	0.22	0.37
1909	7.16	0.76	1.93	2.30	0.88	0.36	0.24	0.03	....	0.03	0.15	0.21	0.27
1910	7.40	1.39	1.01	1.75	1.51	0.53	0.09	0.09	....	0.03	0.21	0.35	0.44
1911	4.63	0.87	0.96	0.90	0.79	0.41	0.03	0.09	....	0.03	0.12	0.06	0.49
1912	6.93	1.46	1.35	1.06	0.60	0.26	0.20	0.17	0.09	0.09	0.26	0.17	1.23
1913	5.75	2.00	0.76	0.85	0.51	0.34	0.14	....	0.17	0.14	0.20	0.25	0.39
1914	3.58	0.75	0.39	0.75	0.64	0.36	0.14	0.06	....	0.06	0.08	0.17	0.25
1915	6.34	0.79	0.60	0.98	1.88	0.49	0.16	0.08	0.05	0.08	0.11	0.22	0.37
1916	14.50	6.32	3.04	1.67	0.75	0.56	0.32	0.16	0.13	0.05	0.16	0.43	0.89

* Compiled from number of deaths as given in Registration Reports, State of Massachusetts, 1887-1916, except data for 1912, from Mortality Statistics U. S. Census Bureau.

This corresponds to the experience in England according to Parsons,[1] and apparently represents the general experience in other countries, with some differences in chronology and relative severity of the several phases of the epidemic.

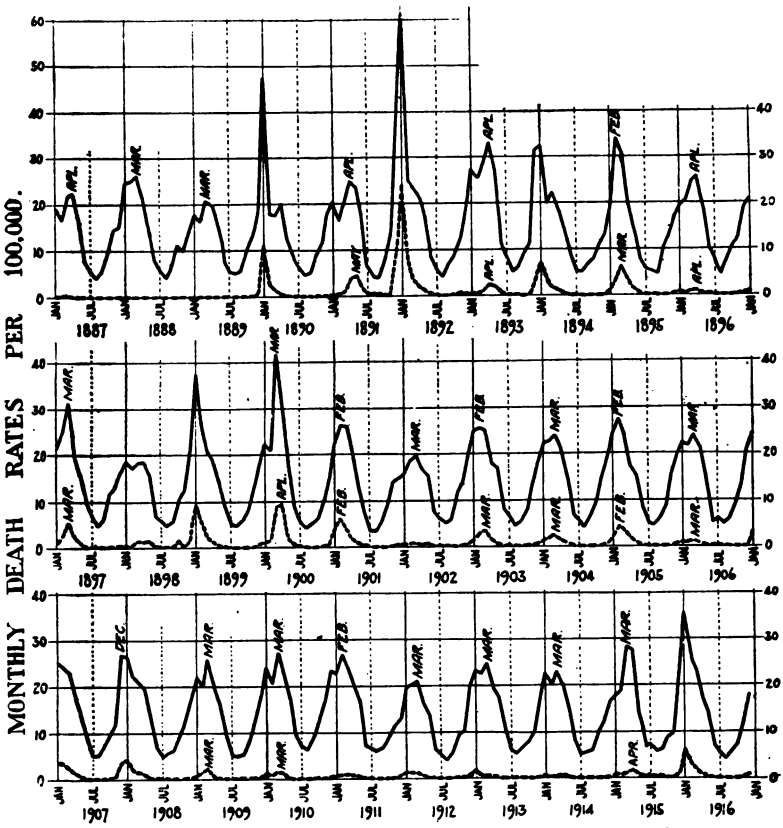

Chart 1.—Monthly death rates per hundred thousand of population, from pneumonia (all forms) and from influenza, in Massachusetts, from 1887 to 1916, inclusive.

COMPARABLE STATISTICS FOR 1910-1918

As comparable statistics for Massachusetts in 1917 and 1918 are not now at hand, it is necessary to turn to other sources for the record of these years. The

1. Parsons, H. Franklin: A Further Report on the Influenza Epidemics of 1889-90, 1891 and 1891-92, Local Government edition, London, 1893.

U. S. Census Bureau has very kindly furnished to me, from tables prepared for publication in the 1917 mortality statistics, the number of deaths by months during 1917 from pneumonia and influenza in certain registration states and registration cities of over 100,000 population, thus continuing through that year the records of monthly mortality available from published mortality statistics from 1910 to 1916, inclusive; and has also furnished records of deaths in certain of these states and cities, by months, during 1918. The latter figures were compiled and submitted by state and local registrars in compliance with a special request from the director of the census. They are merely provisional and the Census Bureau in no way vouches for their accuracy; but they are believed to be sufficiently exact for present purposes.

Owing to limitations of space, the statistics of only three cities (New York, Cleveland and San Francisco) are presented here. These are, however, fairly representative of the whole group of cities and states for which records are at hand. As may be seen from Table 2 and Chart 2, the mortality from influenza and pneumonia in these cities was fairly regular from 1910 till 1915, as was the case in Massachusetts (Chart 1) and generally throughout the registration area of the United States.

SIGNIFICANT RISE IN MORTALITY IN DECEMBER, 1915

In December, 1915, and January, 1916, there occurred in New York and Cleveland a sudden sharp rise in mortality. This, though not shown distinctly in San Francisco, was almost universal and synchronous over the whole of the registration area. While this may have no direct significance in relation to the 1918 pandemic, it is at least of interest as indicating the operation of some definite and widespread factor and suggesting in this group of diseases an epidemic tendency which is perhaps not sufficiently appreciated.

TABLE 2.—ANNUAL DEATH RATES FROM INFLUENZA AND PNEUMONIA (ALL FORMS), BY MONTHS, FOR THE YEARS 1910-1918 (INCLUSIVE), IN NEW YORK, SAN FRANCISCO AND CLEVELAND*

Years	Total	Months											
		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
New York													
1910	229.3	327.8	300.2	343.3	308.5	225.4	162.1	125.5	106.0	126.9	154.7	211.6	365.9
1911	217.7	321.3	325.5	359.0	338.7	287.2	187.2	115.8	97.2	107.6	145.0	195.0	240.8
1912	198.6	266.5	284.5	287.9	254.6	238.3	153.5	112.3	99.0	94.9	157.8	178.5	251.6
1913	199.7	265.0	353.0	342.2	242.7	225.1	158.9	113.5	101.9	100.6	118.4	172.9	213.3
1914	184.3	247.3	293.0	319.4	241.8	211.1	131.6	92.5	86.1	88.1	110.0	162.9	234.3
1915	202.7	253.7	282.2	325.4	344.5	212.1	172.0	103.2	89.2	90.8	120.4	167.1	324.4
1916	189.7	402.5	261.7	252.0	210.9	194.6	133.1	113.7	100.5	87.8	116.4	154.0	242.1
1917	191.9	417.9	316.3	237.3	221.2	202.4	122.8	72.6	78.4	89.5	127.6	185.5	237.7
1918	636.4	348.4	339.0	548.0	432.1	201.4	105.4	81.3	71.8	136.2	351.6	1,259.6	549.8
San Francisco													
1910	128.6	199.9	134.0	168.9	148.2	122.3	101.6	109.8	112.6	87.3	113.2	110.5	113.2
1911	135.7	207.3	150.0	135.6	68.6	91.2	150.0	88.5	83.0	135.0	132.7	144.0	270.9
1912	126.0	236.3	191.6	182.0	131.9	86.9	47.7	51.6	67.9	92.6	84.2	137.5	196.3
1913	139.6	261.7	192.1	194.9	143.5	122.8	91.0	66.8	72.1	99.3	125.5	110.4	194.9
1914	122.6	191.7	180.8	178.5	132.9	107.6	84.1	78.8	63.0	103.1	70.9	97.7	231.0
1915	133.2	214.6	137.4	118.8	125.4	113.6	101.4	90.4	111.0	138.7	116.2	117.4	211.8
1916	133.2	243.9	165.6	162.6	144.3	101.6	84.0	88.9	71.1	76.1	88.9	144.3	221.0
1917	127.5	210.0	185.4	130.0	121.4	125.0	72.3	80.0	77.5	113.8	100.0	144.6	167.5
1918	713.0	231.3	204.3	278.1	310.2	152.6	139.8	78.7	73.8	117.0	3,534.0	2,069.8	1,331.0
Cleveland													
1910	136.3	198.3	180.0	223.0	213.5	148.3	107.9	54.2	48.2	51.8	85.6	138.0	190.0
1911	106.5	174.3	165.9	164.1	155.0	103.4	77.5	40.5	50.6	67.1	81.0	109.0	93.2
1912	114.6	163.6	141.2	159.7	142.7	126.2	91.7	55.2	75.0	80.6	88.8	110.1	185.4
1913	131.9	179.8	205.1	217.5	152.5	147.4	107.5	68.1	60.6	74.3	115.3	130.9	128.6
1914	117.2	160.1	175.2	197.0	201.8	139.9	53.3	51.6	46.3	59.0	66.4	116.0	143.7
1915	162.7	166.5	333.1	252.6	201.8	109.3	77.4	55.5	78.8	59.2	121.8	170.2	336.8
1916	198.5	545.0	209.2	263.8	266.9	211.2	86.6	57.6	82.1	75.7	153.6	175.0	242.9
1917	210.9	344.0	396.0	415.0	238.8	208.0	145.8	90.2	66.4	72.1	160.0	152.9	267.0
1918	257.1	161.3	178.5	190.4	366.3	142.6	60.0	62.5	43.5	48.0	1,812.0	2,135.0	1,376.0

* Data for years 1910-1916 compiled from Mortality Statistics, U. S. Census Bureau, for those years; data for 1917 from table prepared for publication in 1917 Mortality Statistics, advance sheets being furnished by the Census Bureau; data for 1918 from special reports rendered to Director of the Census by city registrars. Populations used are U. S. Census Bureau midyear estimates.

In *Public Health Reports* for Jan. 7, 1916, influenza was reported to be epidemic in twenty-three states in all sections of the United States, an epidemic now generally forgotten.

ANOTHER SHARP AND GENERAL RISE IN MORTALITY IN THE SPRING OF 1918

In the spring of 1918, there was another sharp and general rise in mortality from these diseases, clearly evident in Chart 2. In the larger cities on the Atlantic

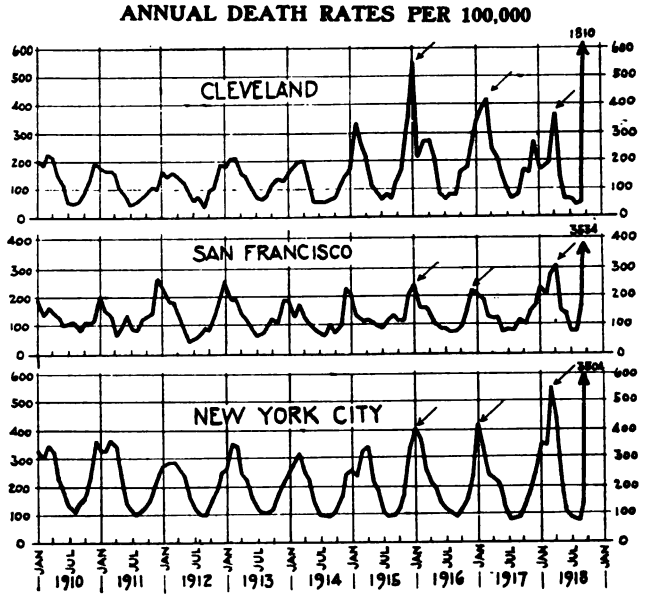

Chart 2.—Annual death rates per hundred thousand from influenza and pneumonia (all forms), by months, 1910-1918, in three American cities.

seaboard, this increase occurred generally during January, February and March, when pneumonia mortality normally reaches its maximum, and the increase was not so evident in all these cities as it was in New York City. In the rest of the country, especially in the central and western states, the increase occurred in April, a month during which pneumonia mortality is generally on the decline; and was sufficient to constitute an

unmistakable departure from the normal. The increased mortality rate extended quite generally into May and in some areas still longer.

This occurrence has, I believe, a definite significance in relation to a coincident prevalence of influenza, and to the subsequent development of the influenza pandemic. Although there is no definite record of a generalized epidemic of influenza in the United States in the spring of 1918, definite local outbreaks were observed at that time. For example, Vaughan and Palmer[2] have described a mild epidemic prevailing in the Oglethorpe camps in March. The commissioner of health of Chicago[3] states, in his special report on the autumn epidemic in Chicago, that in March, 1918, distinct epidemics resembling influenza were observed in certain groups in that city. Stanley[4] in a recent publication describes three epidemics of influenza occurring in April, October and November, 1918, respectively, in San Quentin prison, California. These three epidemics were quite similar and that of April apparently developed from a newly received inmate, presumably infected in Los Angeles, indicating the presence of the infection there at that time.

Opie, Freeman and others[5] of the Army Commission, studying pneumonia at Camp Funston, found that recurrent outbreaks of pneumonia observed there in March, April and May, 1918, were definitely associated with coincident epidemics of a mild type of influenza.

The rise in mortality from this group of etiologically heterogeneous diseases in the spring of 1918, is so sudden, so marked, and so general throughout the United

2. Vaughan, V. C., and Palmer, G. T.: The Communicable Diseases in the National Guard and National Army of the United States During the Six Months from September 29, 1917, to March 29, 1918, Military Surgeon **43**: 392 (Oct.) 1918.

3. Robertson, J. D.: A Report on an Epidemic of Influenza in the City of Chicago in the Fall of 1918, Ed. Series 15, Department of Health, Chicago, 1918.

4. Stanley, L. L.: Influenza at San Quentin Prison, California, Public Health Reports **34**: 996 (May 9) 1919.

5. Opie, E. L.; Freeman, A. W.; Blake, F. G.: Small, J. C., and Rivers, T. M.: Pneumonia at Camp Funston. Report to the Surgeon-General, J. A. M. A. **72**: 108 (Jan. 11) 1919.

States as to point very clearly to the operation of a single definite and specific cause, something largely independent of meteorologic and other local conditions. The observed occurrence of local epidemics of influenza at that time in widely scattered localities, the intimate association established at Camp Funston between the epidemic of influenza and pneumonia, and the subsequent development of the influenza pandemic, all indicate that the increased pneumonia mortality of March and April, 1918, was the consequence of a beginning and largely unnoticed epidemic of influenza, the beginning in this country of the great pandemic which developed in the autumn.

MILD EPIDEMICS OF INFLUENZA IN EUROPE IN APRIL AND MAY, 1918

From various localities in western Europe mild epidemics of influenza are reported in April and May, 1918; and perhaps there may be earlier reports. During June and July extensive epidemics were reported from Great Britain, various parts of continental Europe, China, India, the Philippine Islands and Brazil, with marked effect on general mortality rates in such of these countries for which records are available.

COURSE OF 1918 EPIDEMIC

The course of the epidemic in England and Wales, and in the United States, respectively, is illustrated by Chart 3, which shows the annual death rates from all causes, by weeks, in ninety-six large cities of England and Wales[6] with an aggregate population (1917) of 16,577,344 and in forty-five large American cities[7] aggregating about 22,950,000 population (1918).

In the British cities the epidemic has so far manifested three distinct waves: the first and slightest, in point of mortality, occurring in June and July; the second and most severe in November; the third in Feb-

6. Weekly Return of Births and Deaths Registered in London and Ninety-Five other Great Towns of England and Wales, London.
7. Weekly Health Index, U. S. Census Bureau, Washington, D. C.

ruary and March. Data which need not be cited here in detail indicate that the course of the epidemic in western Europe, generally, was similar. In cities of India the sequence was similar but the mortality far greater. In the United States the epidemic developed more largely in a single wave, during September, October and November. If, however, the epidemic already mentioned as occurring in the spring be considered the first phase, and the explosive outbreak of the autumn, the second, a third phase or recrudescence is quite evident in many areas, though not shown distinctly in

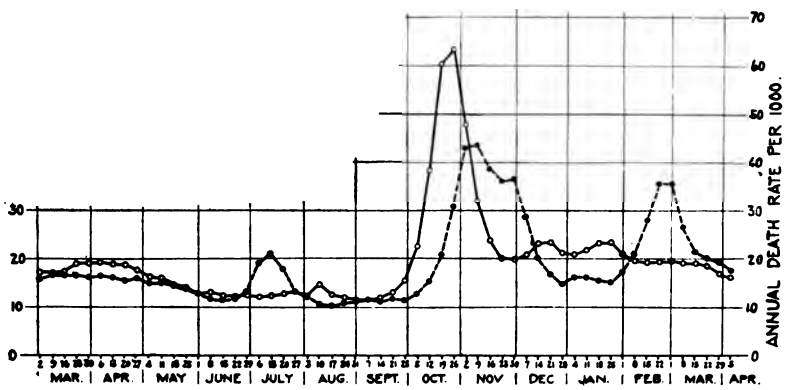

Chart 3.—Annual death rates from all causes, by weeks, March 2, 1918, to April 5, 1919, in forty-five American cities (population, 1918, 22,672,630) and ninety-six large cities of England and Wales (population, 1917, 16,577,344). Continuous line with circles signifies the forty-five American cities, and the broken line with solid dots the ninety-six large cities of England and Wales.

Chart 3, in which are combined a number of widely separated cities the curves of which overlap. In general, this winter recrudescence was less marked in those cities which suffered most severely in the autumn epidemic.

The course of the epidemic in the United States since September is already well known and need not be discussed here in detail. The prevalence of a serious epidemic among the civilian population was first recognized in and around Boston about the first of

September. Within about two weeks the epidemic was general in cities on the Atlantic seaboard, developing a little later among the cities farther west. Rural districts were usually attacked somewhat later than large cities in the same sections. The sequence of the epidemic in three cities (Boston, Washington and San Francisco) is shown in Chart 4. The interval between the peaks of the epidemic in Boston and San Francisco

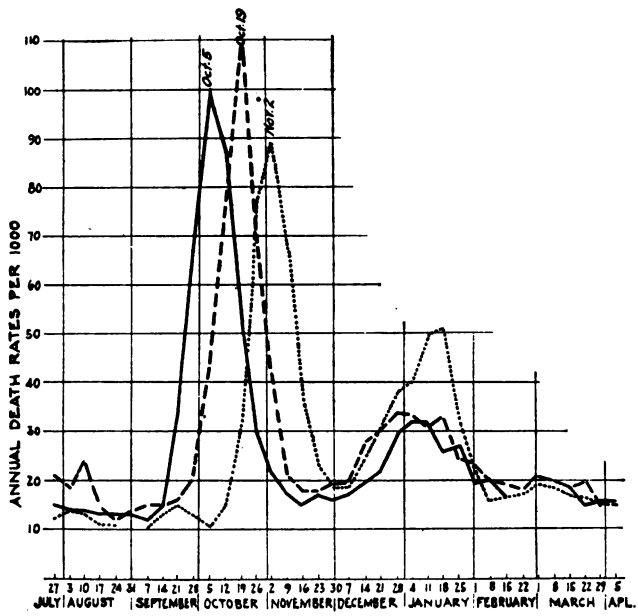

Chart 4.—Annual death rates per thousand from all causes, by weeks, July 27, 1918, to April 5, 1919. The unbroken line is the record of Boston, the dash line of Washington, and the dot line of San Francisco.

is four weeks, which is approximately the maximum difference between any two large American cities in this phase of the epidemic.

CURVES OF MORTALITY IN VARIOUS AMERICAN CITIES

The curves of mortality differed widely in different cities, as illustrated in Chart 5, showing in Philadelphia a very explosive and abrupt curve, observed more fre-

quently among cities on the Eastern seaboard; in New York a less explosive curve, with a more prolonged high mortality rate, as observed more commonly in middle western cities, often with a more pronounced

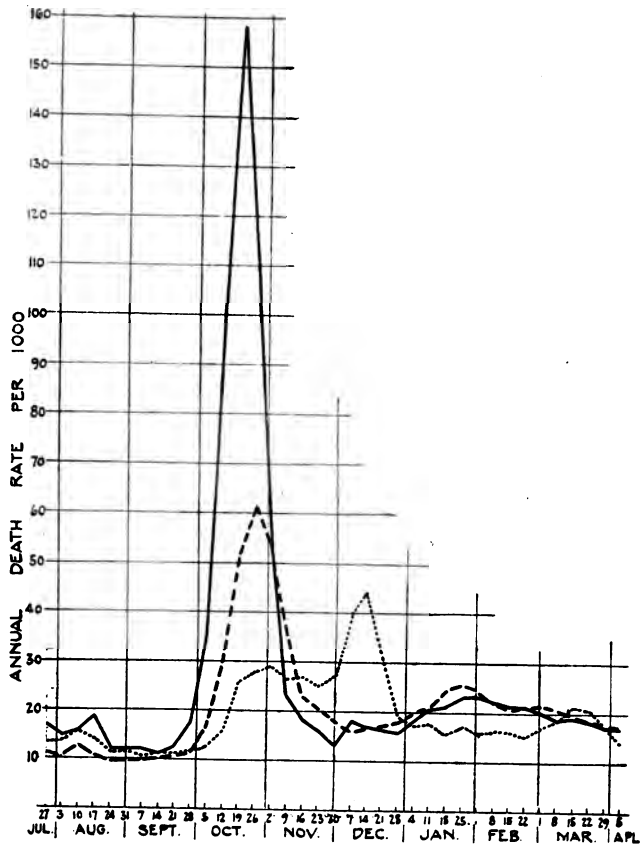

Chart 5.—Annual death rates per thousand from all causes, by weeks, July 27, 1918, to April 5, 1919. The unbroken line is the record of Philadelphia, the dash line of New York, and the dot line of St. Louis.

recrudescence; in Kansas City a still more gradual curve, declining only slightly after the first wave, and with a severe recrudescence, curves of this general character being more common in the middle west.

TOTAL NUMBER OF DEATHS AMONG THE CIVIL POPULATION

Based on incomplete statistics, which represent, however, all the main geographic divisions of the country, including both urban and rural populations, the deaths among the civil population of this country directly attributable to the epidemic are estimated at not less than 450,000, or more than 4.0 per thousand. This rate exceeds even a liberal estimate of the net excess mortality rate in Massachusetts during the four years (1890-1893) following the influenza outbreak in 1889-1890.

DIFFERENCE IN MORTALITY IN VARIOUS GEOGRAPHIC GROUPS

Classifying the forty-five cities of the Weekly Health Index into three broad geographic groups there is a noticeable difference in mortality. In the cities east of the line of the Appalachians, the excess mortality from pneumonia and influenza during the weeks ending Sept. 14, 1918, to March 1, 1919,[8] was approximately 5.6 per thousand; in cities between the Rocky Mountains and the Appalachians, 4.35; and in those of the Pacific Coast, 5.55 per thousand.

Notwithstanding this general geographic relation, there are notably wide differences in the mortality rates of individual cities in the same section, even between cities close together, differences which are not as yet explained on the basis of climate, density of population, character of preventive measures exercised, or any other determined environmental factor.

More intimate details of epidemiology can be given only the briefest mention here. In order to secure reliable statistics of morbidity, the Public Health Service has made special house-to-house surveys in a number of localities,[9] ascertaining the number of persons

8. Summary, Influenza Epidemic, U. S. Census Bureau, Weekly Health Index, March 1.

9. For a description of methods and more detailed statistics of certain localities, compare Public Health Reports 34: 491 (March 14) 1919.

affected, the dates of onset and a few other simple facts in accurately enumerated groups representative of the general population. Partial analysis of the results of these surveys, in eight localities,[10] giving an aggregate of 112,958 persons canvassed, show the following chief facts of interest:

RESULTS OF HOUSE-TO-HOUSE SURVEYS

The percentage of the population attacked varied from 15 per cent. in Louisville, Ky., to 53.3 per cent. in San Antonio, Texas, the aggregate for the whole group being about 28 per cent.[11] This agrees with scattered observations in the first phase of the 1889-1890 epidemic, when the attack rate seems to have varied within about these limits. The case incidence was found to be uniformly highest in children from 5 to 14 years old, and progressively lower in each higher age group. It was slightly higher in females than in males of corresponding age; usually higher in the white than the colored population.

The ratio of pneumonia cases to total population varied from 5.3 cases per thousand in Spartanburg to 24.6 per thousand in the smaller towns of Maryland. The pneumonia rate showed little correlation with the influenza attack rate.

The ratio of deaths to population varied from 1.9 per thousand in Spartanburg to 6.8 in Maryland towns. The death rate was by no means parallel to the influenza attack rate, but was correlated closely with the pneumonia rate. In other words, the case fatality of pneumonia tended to be fairly constant, around 30 per cent., except in San Antonio, where it was only 18.5 per cent. The death rate was notably high in children under 1 year old, in adults from 20 to 40, and in per-

10. Data from surveys of population groups as follows: New London, Conn.; Baltimore; certain smaller towns and rural districts in Maryland; Spartanburg, S. C.; Louisville, Ky.; Little Rock, Ark.; San Antonio, Texas; San Francisco.

11. The surveys were made mostly during December, after the first wave of the epidemic had subsided, but before the second wave. Later figures would add somewhat to the incidence.

sons over 60; higher in males than in females of comparable ages; higher in the white than in the colored.

The case fatality was likewise higher in these age groups: under 1 year, 20 to 40, and over 60 years; and it is this fact, rather than the incidence rates, which determines the death rates in different age groups.

Chart 6 shows the attack rates, death rates and case fatality rates in various age groups.

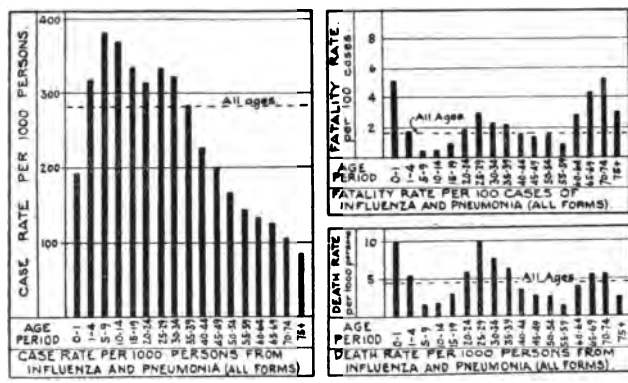
CASE RATE PER 1000 PERSONS
All ages
AGE PERIOD
CASE RATE PER 1000 PERSONS FROM INFLUENZA AND PNEUMONIA (ALL FORMS)
FATALITY RATE per 100 cases
All Ages
FATALITY RATE PER 100 CASES OF INFLUENZA AND PNEUMONIA (ALL FORMS)
DEATH RATE per 1000 persons
All Ages
DEATH RATE PER 1000 PERSONS FROM INFLUENZA AND PNEUMONIA (ALL FORMS)

Chart 6.—Influenza records for 1918. Case rates, death rates and fatality rates among persons of different ages in certain areas surveyed in Maryland; San Antonio, Texas; San Francisco; New London, Conn.; Louisville, Ky.; Little Rock, Ark., and Spartanburg, S. C.

THE IMPORTANT QUESTION OF IMMUNITY

Concerning the important question of the immunity conferred by an attack of influenza, the evidence is not conclusive, chiefly because of the uncertain differentiation between influenza and other infections. Parsons, from his study of the last epidemic,[1] inclines to the view that an attack of influenza in the earlier years of the epidemic conferred a considerable but not absolute immunity in the later outbreaks.

In Baltimore, where our first canvass of 33,776 people was made between Nov. 20 and Dec. 11, 1918, a second canvass of the same population was made in January to determine the extent of the recrudescence reported in December. Among 32,600 people included in this canvass, 724 cases of influenza were found to

have occurred since the previous survey. Of this number 121 cases were reported as second attacks, but on investigation through the attending physicians or by a medical officer, the clinical diagnosis of both attacks as influenza was confirmed in only 26 cases, or 0.37 per cent. of the total, and even in these cases the diagnosis is necessarily uncertain. Considering that 23 per cent. of the population had had influenza prior to December 11, the proportion of second attacks should have been much greater if no immunity had been acquired. A second canvass in San Francisco gave generally similar results. The data collected for a study of this question from other angles have not yet been analyzed.

GENERAL CHARACTERISTICS OF EPIDEMIC

In general, this epidemic has been quite similar to that of 1889-1890 in its early development, first in mild, scattered outbreaks, later in a severe world-wide epidemic; in the rapidity of its spread, and in its high case incidence. It has been notably different in a much higher frequency of pneumonia and consequently much higher mortality, especially among young adults.

Such evidence as has been collected confirms the conclusion previously reached that the infection is transmitted directly by "contact" in the broad sense. It appears probable, however, that the infection was already widely disseminated in this country some time before a serious epidemic was recognized.

PROBABILITY OF RECURRENCES IN THE NEAR FUTURE

The question of most practical and immediate interest is the probability of recurrence in the near future. Recurrences are characteristic of influenza epidemics; and the history of the last pandemic and previous ones would seem to point to the conclusion that this one has not yet run its full course. On the other hand, this epidemic has already shown three more or less distinct phases and has been more severe, at least in mortality,

than the three-year epidemic of 1889-1892, facts which may justify the hope, though not the conclusion, that it has run its course already.

It seems probable, however, that we may expect at least local recurrences in the near future, with an increase over the normal mortality from pneumonia for perhaps several years; and certainly we should be, as far as possible, prepared to meet them, by previous organization of forces and measures for attempted prevention, treatment and scientific investigation.

FUTURE STUDY AND CONTROL

As regards preventive measures, the efficacy of those carried out in recent months is not proved, and we can only continue to follow the apparently sound principles already applied. It seems hardly logical to expect that any measure short of effective specific immunization will afford lasting protection to the general population; but we may perhaps hope to delay the spread of infection, thus affording better facilities for treatment of the sick, and this is an achievement well worth while.

With reference to scientific investigations, these should not be conditioned on recurrence of the epidemic. Now is the time to inaugurate comprehensive laboratory and field investigations of influenza and pneumonia, to be continued not for a few months, but for a series of years, since a knowledge of influenza during the intervals between epidemics is essential to the understanding of epidemics. In this connection one of the most essential requisites for a better understanding of the disease is better differential diagnosis of endemic influenza, with more careful observation and recording of the relatively mild, indefinitely diagnosed epidemics of supposed influenza which are noted from time to time in the intervals between definite epidemics. Even in the absence of a definite diagnosis of individual cases, much would be added to the history of influenza by describing such outbreaks more fully and making them matters of more general record.

BACTERIOLOGY OF RECENT PANDEMIC OF INFLUENZA AND COMPLICATING INFECTIONS

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When the recent outbreak of influenza appeared, it was assumed by all that it was probably due to the same cause as that of 1889. Health officials, epidemiologists and bacteriologists, already overwhelmed by the demands of the war, were called on to investigate and combat the infection.

The first appearance of the epidemic was in Europe. Bacteriologists, while keeping an open mind, naturally first sought for the influenza bacillus isolated by Pfeiffer from endemic cases of influenza-like infections some two years after the 1889 epidemic.

He had established a relationship between this bacillus and infections of the respiratory tract and had assumed that it was the primary agent in the great pandemic. Investigations since then have thrown considerable doubt on this assumption, and many have now come to consider the bacillus as only one of several varieties of bacteria which have a special selective tendency to attack the mucous membranes of the upper respiratory tract.

The reports from different investigations in Europe have been most conflicting. Influenza bacilli were found in some localities to be present in nearly every case, while in others bacteriologists isolated them from only a small minority of the patients.

In their place, pneumococci, streptococci and gram-negative micrococci were found. Frequently, several

varieties occurred together. A few observations in France and England indicated that a filtrable virus was present in at least some of the cases. As a filtrable virus had already been demonstrated in outbreaks of common colds, when no epidemic existed, this information, in spite of its great interest, simply added one more line of investigation.

The possibility that more than one epidemic of an influenza-like disease was prevailing in Europe makes it advisable to concentrate our attention on the results of the bacteriologic findings in this country. Here, the unity of the epidemic which swept over the land was unmistakable.

NECESSARY PROOF

To identify a micro-organism as the cause of a widespread epidemic, the germ must be capable of producing the type of disease under investigation; it must be present in the advancing area in all cases at the beginning of the infection, and in any outbreak it must have the same characteristics when freshly isolated from different patients. The repeated transfer of a pathogenic germ from patient to patient allows the most characteristic forms to increase, so that until an epidemic is on the wane we find that isolations from different cases from different localities are practically identical. When the different cultures are grown in artificial mediums, under suitable and similar conditions, the isolations from different sources will continue to hold their characteristics sufficiently to be studied and compared.

Even well trained bacteriologists frequently fail to realize that an epidemic strain is alike everywhere in cases belonging to the epidemic.

Before considering the results so far obtained and drawing our conclusions, let us consider for a moment the special problem before us. Epidemic influenza is a disease primarily attacking the respiratory passages.

The symptoms during life and the lesions in the dead, although fairly distinctive in the cases at the height of the epidemic, are by no means so in those occurring after it has passed. Whatever the primary infecting micro-organism may be, there is no doubt that in most cases other pathogenic bacteria are decisively associated. Many of these produce very similar symptoms and lesions. It is perfectly possible that a strain of any one of these bacterial varieties may have increased in virulence to an extent enabling it to initiate an epidemic. The micro-organism responsible for the epidemic may either be a microbe hitherto unknown to us or to a new and more virulent strain of some known form. Even if we assume the latter alternative, we have a difficult problem to obtain the proof, for we must discover how to identify it as a new strain. Supposing that we had found pneumococci in all cases, but that in some we had isolated only Type I and in some only Type II. Instead of this being evidence for a pandemic pneumococcus strain, it would be just the opposite, for two different strains cannot be responsible for one epidemic.

For our purpose, the two types are as distinct as if they were diphtheria and tubercle bacilli; and if either is the pandemic strain, it must occur in all the cases.

Suppose we find in every case a Type II pneumococcus. This is very suggestive, but it is really no proof unless we can show some peculiarity different from that in the cases of respiratory infections before the epidemic. Only then have we probably obtained the culprit. Because of the lack of this evidence, Pfeiffer made his hasty conclusion.

The most delicate test that we have for identity of strains is that animals injected with them produce identical antibodies.

The resemblance between the agglutinins produced is usually selected as the best evidence of identity or dissimilarity. With the filtrable viruses we have to

depend on finding some susceptible animal, or revert to human volunteers and if successful in producing infection, test for specific immunity.

RESULT OF RECENT INVESTIGATIONS

The pandemic of 1918 is over. The difficulty of being certain that any suspected cases are due to the pandemic virus is gradually increasing. It is probable that if we have not at the present time gathered sufficiently convincing evidence to convict some germ we shall have to wait for another epidemic to solve the problem. It will be well to summarize very briefly some representative investigations.

Keegan made cultures from a number of cases in the virulent outbreak at the First Naval District at Chelsea, Mass. Cultures from twenty-three cases gave influenza bacilli in nineteen, and in some no other bacteria were found. In four cases he considered a streptococcus of the hemolytic variety the dominant organism and in seven cases the influenza bacillus. The earlier the cultures were taken, the greater was the percentage of influenza bacilli.

Spooner, Scott and Heath found evidence that the cases reacted to the influenza bacillus invasion by the production of antibodies. At the end of the first week agglutinins appeared sufficiently in the blood of some cases to agglutinate influenza bacilli when in a 1 : 50 dilution. In five weeks the serum of some agglutinated when in a dilution of 1 : 800. They found no evidence of strains of influenza bacilli. They did not use the more delicate and accurate absorption methods in their tests. These investigations afforded evidence that in that extensive outbreak the influenza bacilli played an important part either as the primary agent or as a secondary invader. In four cases a hemolytic streptococcus was shown to play an important and even decisive part.

In the Central West, in twenty-three cases of acute influenza in the early stage, Opie, Freeman, Blake,

Small and Rivers subjected the patients to examination and obtained influenza bacilli from all. The examination of the sputum from sixty-nine cases of pneumonia revealed influenza bacilli in forty-three.

Pneumococci were found in every case, but were of different types. The men named agree with Keegan as to the etiologic importance of the influenza bacillus in this epidemic. They place the sequence of events as follows: At the time of infection, *B. influenzae* descends into the bronchi; later, pneumococci may invade the inflamed bronchi, enter the lung and produce either lobar pneumonia or bronchopneumonia. Hemolytic streptococci may at any time descend and infect the pneumonic lung.

Although Keegan, Opie and their associates believe that the influenza bacilli are the causative agent, they present no real evidence. Opie demonstrated in some groups of healthy soldiers, that 50 per cent. could be shown to harbor influenza bacilli. No proof was obtained that these bacilli differed in any way from those isolated from the patients. Their evidence is as strong that the bacilli are secondary invaders as that they were the primary ones.

In 278 cases occurring in New York, Williams found influenza bacilli as shown in Table 1.

TABLE 1.—EXAMINATION FOR INFLUENZA BACILLI

Group	Influenza Bacilli Per Cent. Present
Hospital cases	80
Marines*	100
Home for children	98
Material examined:	
Lungs	80†
Tracheas	96
Heart's blood	10

*The marines came from different vessels.
†Seventeen per cent. in fine cultures.

We found that the best site for the material selected, the use of the best mediums and long training in the study of influenza colonies were important in finding the bacilli.

In 100 cases, among civil and soldier patients in Chicago, Nuzum, Pilot, Stangl and Bones found the results given in Table 2.

TABLE 2.—BACTERIA FROM SPUTUM, NASOPHARYNX AND TONSILS

	Pneu. %	B. Inf. %	St. Hem. %	Mic. Cat. %
Washed bronchial sputum	70	4	20	5
Cultures from nasopharynx	38	0	7	5
Cultures from tonsils	74	0	37	7

Five healthy persons volunteered to be inoculated in the nostrils with the filtrate from infected mucus. A very slight coryza in one and a moderate attack in another resulted. They think the results insufficient to indicate the pandemic to be due to a filtrable virus. They believe that in their cases pneumococci of unusual virulence were the most important early secondary invaders. Influenza bacilli were less important than many other bacteria.

Lamb and Brannin, at Camp Cody, Deming, N. M., found in pneumonia, in sputum specimens, the bacteria as shown in Table 3.

TABLE 3.—BACTERIA PRESENT IN PNEUMONIA*

	Cases	Per Cent.
Pneumococcus (all types, but chiefly Type IV)	310	89.1
Streptococcus (one third hemolytic types)	222	63.3
B. influenzae	89	23
M. catarrhalis	21	6

* Blood agar was used for platings.

A careful survey of all the literature leaves the same impression as that left by the brief summary of the few representative investigations I have just given.

There is no proof that any one germ is present in all cases. The influenza bacillus has the lead among the possibilities, partly because of its historical position and partly because, as it requires much training to isolate it from a mixture of other bacteria, the thought remains in the minds of many that the failure to obtain it in some outbreaks is due, not to its absence, but to lack of training in the bacteriologist seeking it.

If isolations from a number of cases proved to have identical characteristics, the probability that the influenza bacillus was the cause of the epidemic would be great, while if many strains were found it would be slight. Williams and I decided, therefore, to test the immunologic reactions of isolations from more than 100 cases. We also tested great numbers of isolations from a few cases. Miss Valentine and Miss Cooper carried out the tests with the utmost care. They used, for every strain, direct and absorption methods.

DIFFERENT STRAINS

It was found that from the same case either all or the great majority of isolations were identical in their reactions, but that the majority of the isolations from different cases differed from each other either completely or essentially. The results seemed to show that influenza bacilli, like pneumococci, have gradually through the years altered on the mucous membranes of healthy carriers into many strains which, while having many essential characteristics in common, are still different in their susceptibility to specific immune substances and perhaps in other reactions.

In order to test the stability of the strains, we passed several strains through a series of animals, and others were grown for many generations on different mediums, but without causing any appreciable change. An interesting observation was made during this work that when a plate culture is made from material containing several strains, apparently pure colonies will not infrequently yield two different strains. The resultant mixed culture will agglutinate with each of the two serums. Even further plating may fail to separate them. If thoroughly shaken before plating, pure cultures of each strain can usually be isolated from the majority of the colonies.

An important point was whether the infecting strain could be depended on to produce the major part of the

organisms in a case. If it did, isolations from the plates made from nasopharyngeal cultures could be considered as belonging to the infecting strain.

Some of our laboratory findings are instructive: One of the workers developed an acute bronchitis. Cultures revealed abundant influenza bacilli. Fifty fishings of colonies from the plates were found on testing to give forty-nine identical organisms and one that belonged to a different strain. Another bacteriologist, by accident, received an infection from a freshly isolated culture. About thirty colonies were fished from the plate cultures, and all proved to have identical characteristics. Other tests gave the same results.

PRIMARY AND SECONDARY INVADERS

It seems right, from the results mentioned above, to assume that the infecting strain is in great excess during an infection and that in nearly every case the colony tested will represent the infecting strain and that the proof that the patients are infected by different strains indicates almost certainly that bacilli were present before and that some other virus created conditions permitting the latent bacilli to attack the tissues.

It is perhaps well to state that not only did Miss Valentine and Miss Cooper subject themselves to the most careful controls, but that they also tested the strains with marks of identification that left them in ignorance of the origin of the cultures.

There was no question in our minds of the essential accuracy of the results.

These results appear to us to throw the influenza bacilli in the cases studied as clearly into the class of secondary invaders.

We believe that the other micro-organisms, such as certain streptococci and pneumococci which are under suspicion in different localities will be found after subjection to similar severe tests not to possess the necessary identity of characteristics to allow them to

remain under serious consideration as the primary agent in this epidemic, but rather like the influenza bacillus, to be reckoned among the most important of the secondary invaders.

Our final conclusion is, therefore, that the micro-organism causing this epidemic has not yet been identified.

THE SYMPTOMATOLOGY AND COMPLICATIONS OF INFLUENZA

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To present a paper on this subject at a time when the periodicals are filled with articles of similar title, and to an audience, almost every member of which has had an all too large personal experience with the subject, requires a word of explanation, if not of apology. To be accurate, the title should read "The Symptomatology and Complications of Influenza as Seen in the Army in This Country." No attempt is made to record the manifestations of this disease as they appear in children, in women, or in persons of advanced years; nor as observed in our own, or in other, armies in Europe. Moreover, the statements to be made relate solely to the great epidemic which swept over the country in the autumn of last year. It is interesting to note, however, that in the late winter and the spring of 1918, epidemics of what was regarded locally as influenza appeared in several of the army camps and posts. The symptoms bore a close resemblance to those of the great epidemic six months later, but these local epidemics were distinguished from the latter by the mildness of the symptoms and the rarity of serious complications.

The data on which this paper is based were furnished by reports to the Surgeon-General from seventy-two base and general hospitals scattered throughout the entire country.

In this large number of reports, two features stand out with great distinctness: first, the singularly uni-

form and clear-cut clinical picture presented by the cases of uncomplicated influenza in the same camp; and, second, the striking agreement by observers in the various hospitals throughout the country as to the characteristic symptoms of the disease. From these reports there can be no possible doubt that, among the soldiers at least, the disease in its march across the country, from the Atlantic to the Pacific, preserved a remarkable uniformity in its clinical picture.

Of forty-seven reports on this subject, thirty-six gave the period of incubation as three days or less. In half of this number it was given as two days or less. In several reports it was stated as being usually not more than twenty-four hours. On the other hand, in several instances, the interval was placed at from three to seven days and, in one instance, at from seven to ten days. In one camp, in the case of five men with whom the interval between exposure and the onset could be accurately determined, the period in each instance was forty-eight hours. It seems safe to conclude, therefore, that the incubation period is, in general, very short and that the most frequent interval is about forty-eight hours.

In what follows it should be clearly understood that, for the moment, only the symptoms observed in simple, or uncomplicated, influenza are being considered.

ONSET

There is practical unanimity in the assertion that the onset is abrupt in the great majority of cases. Most reports give the percentage of abrupt onsets to the whole number as from 80 to 90. The initial symptoms were surprisingly constant and uniform, being chilliness, prostration, fever, headache, backache, and pains in the limbs. Somewhat less frequent initial symptoms were an irritating, dry cough and sore throat. To these symptoms must be added a char-

acteristic mental state and a peculiar facies which will be described later.

SYMPTOMS

Prostration.—This was one of the earliest, as well as one of the most constant, symptoms. Frequently extreme, it varied much in its severity and in its duration; but it was characteristic of many cases that the muscular weakness persisted long after the temperature had become normal and all the other symptoms had disappeared.

Respiratory Symptoms.—There is general agreement that cough was present at some time in almost all cases, even in most of those classed as uncomplicated. During the early part of the illness it was usually of a hard, dry, racking character, with little or no expectoration, and was commonly associated with a feeling of retrosternal soreness or pain. During the later days of the attack it usually became looser and was accompanied by sputum and by the physical signs of tracheitis or bronchitis. The sputum varied much in character and in quantity. At first scanty, tenacious and mucous, it later became more profuse and mucopurulent. Occasionally, even in uncomplicated cases, it showed streaks of blood and, rarely, blood in considerable quantities.

The frequency of hoarseness as a symptom seemed to vary much. Often the husky voice appeared to depend on the dry, congested state of the pharynx, and on the great prostration, rather than on an actual laryngitis.

Coryza was, in most reports, classed as a frequent manifestation. It was by no means constant, however, and, in some hospitals, seems to have been of infrequent occurrence.

Epistaxis was a striking symptom in many patients. It was present in approximately one fourth of the cases, and sometimes was so severe and persistent as to cause very serious concern. Some observers noted

that it seemed to be more frequent in those patients who, later, showed evidences of pneumonia, than in those who did not.

The respiratory rate in simple influenza showed very little disturbance. In relation to the height of the temperature it was notably low. A steady rise in the breathing rate was one of the most trustworthy indications of the existence of a complicating pneumonia. The physical signs of the chest were usually quite normal during the first day or two of the illness, and, indeed, not infrequently throughout the attack. Often, however, sibilant and sonorous sounds, with, or without, scattered, coarse râles, were audible in the latter part of the illness.

Circulatory Symptoms.—There is abundant testimony to the effect that one of the characteristic and striking features of influenza is a slow pulse. Even with a high temperature the rate was usually only 80 or 90 per minute. Rarely was it more than 100, and not infrequently it was as low as 70. A tendency to dicrotism was common. With the fall of temperature at the beginning of convalescence, the pulse sometimes dropped to 50 per minute. Disturbances of rhythm were rare. Changes in the heart's size, or evidences of serious disturbance of the cardiac function were almost unknown. In a certain proportion of the convalescents, however, persistent tachycardia occurred.

The arterial blood pressure seemed to show no characteristic or significant change. A tendency toward unusually low diastolic pressure is noted in one or two reports.

The blood showed a striking and constant feature in the small number of the white blood cells. The count rarely exceeded 10,000 per cubic millimeter, and was usually less than 6,000. A leukopenia of from 2,000 to 3,000 was by no means uncommon. Even in the presence of a complicating pneumonia, the leukopenia tended to persist. The reduction was mainly at the expense of the polymorphonuclear cells.

Symptoms Referable to the Nervous Symptoms.—Of these, pain was much the most conspicuous. Headache, usually frontal, constituted one of the earliest and most constant of symptoms, and was generally associated with severe backache and aching pain in the extremities. As has been said, dull, retrosternal pain was frequently complained of. Abdominal pain was of rare occurrence. Occasionally, but rarely, there was marked general hyperesthesia of the skin and underlying tissues.

Great apathy, mental dulness and somnolence marked the early stage of the attack in most cases, and with these symptoms there were usually also great depression of spirits and loss of "nerve." In a few of the reports, insomnia is described as of frequent occurrence.

In uncomplicated influenza, delirium was rarely seen. The syndrome of meningismus also was very rare. One point in which this epidemic seemed to differ from that of 1889-1890 was in the absence of severe neuralgic pain, either as a symptom or as a sequel.

Gastro-Intestinal Symptoms.—In general, gastro-intestinal symptoms played a very inconspicuous rôle in the clinical picture. In only one out of seventy-two reports were cases with predominant gastro-intestinal symptoms classed as frequent. In almost all the others such cases were described as rare. Nausea was not uncommon, and vomiting occurred occasionally, but was rarely severe or persistent. Troublesome diarrhea was conspicuously infrequent. Abdominal tenderness was sometimes encountered, but seemed usually to be either a part of a general hyperesthesia or related to inflammation in the chest which involved the diaphragmatic pleura. Very rarely it was caused by a complicating local or general peritonitis. A recognizable swelling of the liver or spleen seemed to be no part of the usual clinical picture.

Sore throat was frequently complained of, and was due to congestion and inflammation of the pharynx and soft palate rather than to tonsillitis. The uvula commonly was swollen, red and edematous at its tip.

Cutaneous Manifestations.—Perhaps no group of symptoms was more varied and interesting than that referable to the skin. One of the characteristic and striking initial symptoms was the hot, turgid, flushed appearance of the face which, with the swollen and injected conjunctivae, suggested to many observers the facies of measles without the characteristic eruption. The flushing often extended beyond the face and neck to the chest and trunk generally. Sometimes it assumed the character of a distinct, erythematous rash, which occasionally was so punctate as to bear a close resemblance to that of scarlet fever. This resemblance was sometimes accentuated by the character of the desquamation which followed.

Occasionally, the eruption, instead of being erythematous, was composed of discrete macules scattered over the face and the upper part of the trunk, and showing, at times, a tendency to appear in successive crops.

Herpes of the face and lips was seen in perhaps 10 per cent. of the cases. In spite of the frequency of epistaxis and the occasional tendency to free bleeding from the bronchi, hemorrhagic skin eruptions, either as petechiae or as ecchymotic spots, were extremely rare. Sweating was very common, even in cases in which it could not be ascribed to the use of diaphoretic drugs. Itching of the skin was not a symptom. Jaundice in simple influenza was very rare.

The Organs of Special Sense.—Injection of the conjunctivae was one of the most constant of the early symptoms, and, with the flushed face, the crimson or sligtly cyanotic lips, and the dull, apathetic expression, made up a facies which, by general agreement, is characteristic of and peculiar to influenza.

Another common symptom was pain and stiffness on movement of the eyeballs. Photophobia, while occasionally very marked, was a much less frequent symptom. Loss of power of accommodation was noted in a few cases.

Earache is classed, in most reports, as an infrequent or rare symptom in the uncomplicated cases. Disturbances of hearing were extremely rare, as were also disturbances of the sense of taste and of smell.

Urinary Symptoms.—Among the outstanding clinical features of influenza must, I think, be included the surprising immunity of the kidneys and, indeed, of the whole urinary tract, from damage by the virus of that disease. The testimony is universal that serious injury to the kidneys was almost unknown.

While traces of albumin were not infrequently found in the urine during the febrile period, considerable amounts of albumin were extremely rare, as were also casts in significant number, hematuria and evidences of disturbed renal function.

Inflammation of the pelvis, of the kidneys and of the bladder also were rarely seen.

CONVALESCENCE

The rapidity with which, in cases of uncomplicated influenza, complete recovery was established, varied greatly. In a considerable proportion of cases a very few days were all that were required. In a majority of the cases, however, complete recovery was more gradual, and, in not a few cases, convalescence occupied a period of several, or even of many, weeks. In these cases the chief symptoms during this time were muscular weakness and lassitude, mental depression and persistently rapid heart action.

COMPLICATIONS

In considering the complications of influenza, it must be admitted that it is sometimes difficult to draw a sharp line between conditions which should be regarded

as a part of uncomplicated influenza and such as should properly be looked on as definite complications. The distinction must necessarily be a somewhat arbitrary one. This is not the place for a discussion as to the propriety of regarding pneumonia as an intrinsic part of influenza. In spite of the fact that in certain cases the pulmonary inflammation seems to be present from the very onset of the illness, there are, it is believed, sound theoretical and practical reasons for following the usual custom of placing pneumonia in the category of complications.

Pneumonia.—In the Army reports, the incidence of pneumonia among cases of influenza varies from 8 to 23 per cent. These variations are to be explained in part, but only in part, by the difficulties in many instances attending the diagnosis of pneumonia, and by the fact that in different hospitals widely different criteria have been used as the basis for the diagnosis.

In most hospitals the percentage of cases of influenza complicated by pneumonia has been between 10 and 15.

From the extraordinary variety of the pulmonary lesions found in patients dying of influenzal pneumonia, as well as from the multiplicity of types of the infecting micro-organisms, it is not surprising that the clinical picture should be exceedingly varied and complex. To cover in detail all of these clinical variations is far beyond the scope of this review. Only the more important and salient features can be touched on. It is necessary, however, to emphasize the close relation which exists between the purely clinical aspects of the disease and the nature of the dominating organism in the lung. This relation seems to be especially important in the case of *Streptococcus hemolyticus* and of *Staphylococcus aureus.*

Onset: With respect to its mode of onset, influenzal pneumonia may be divided into three groups of cases: first, those in which the symptoms and signs of pneumonia develop almost imperceptibly in the course of

the active, febrile stage of the influenza, the patient gradually becoming sicker at a time when convalescence might naturally be expected; second, those in which the pneumonia supervenes after the patient has definitely entered the stage of convalescence, and usually after the temperature has been normal for several days; third, those cases which, from the very beginning of the illness, bear the aspects of a pneumonia. In such cases the onset of the attack is apt to be marked by a distinct rigor. Except in this last class of cases a chill is infrequent as one of the initial symptoms of pneumonia. Usually the onset is marked by a more or less gradual rise in temperature and by an increase in all of the respiratory symptoms.

Outstanding Clinical Features: The following may be classed as the outstanding clinical features of influenzal pneumonia as seen in the Army as compared with primary pneumonia of the familiar type:

The temperature usually showed a less abrupt rise, a somewhat lower range of level, a greater tendency to the remittent type, and, in cases in which the patients recovered, a less critical fall to normal. The pulse rate tended to maintain a somewhat lower level than is customary in pneumonia, and in certain cases was conspicuously slow. In unfavorable cases, however, the rate often became very high.

Much the same may be said of the respiratory rate. In many cases, during the early days of the pneumonia, the breathing rate was hardly greater than normal and, even in the presence of deep cyanosis, the breathing was sometimes surprisingly slow and quiet. This, of course, does not apply to all cases. In some, especially in the fulminant cases with early pulmonary edema, the respiratory distress was a marked feature, and the breathing was often very rapid as well as labored.

The importance of cough as a symptom varied greatly. In many cases it was distressing enough, but

in general it may be said that a much larger proportion of influenzal pneumonias is characterized by almost complete absence of cough than is the case with primary pneumonia. The pneumonia wards in the great Army hospitals during the epidemic were often strangely quiet.

The sputum showed extraordinary variations, both in character and in quantity. Usually it was much more profuse and less viscid than in primary pneumonia, and of mucopurulent or of frankly purulent character. Blood was usually present at some time, but less often had the characteristic rusty or brick dust appearance than that of unchanged blood. In many cases, considerable amounts of blood were raised. In the fulminant cases, with early and intense edema, great quantities of pinkish, frothy, watery fluid were poured from the bronchi. In not a few cases there was complete absence of sputum.

The characteristic sharp, stabbing pain of pneumonia was conspicuous by its rarity. A majority of the patients had little or no pain of any sort. Often the pain was referred to the sternum and had a "gnawing" or "burning" character.

The physical signs of the chest were distinguished by their late appearance, their indistinctness, their wide distribution, their slow disappearance and the infrequency of the signs of frank consolidation. The signs were almost always bilateral. They usually appeared first over the lower lobes posteriorly in the form of small areas of fine, crackling râles, impaired resonance, and great diminution or suppression of the vesicular murmur.

Cyanosis.—One of the distinctive features of the pneumonia complicating influenza was the prevalence of cyanosis of a degree which is quite exceptional in the familiar primary type of the disease. When associated, as it often was, with marked pallor, it gave a peculiar dark gray tone to the skin which early came to be recognized as of sinister import.

Chickering[1] associates a special type of cyanosis of "cherry-red indigo-blue color" with those cases in which *Staphylococcus aureus* is the dominant organism in the lungs.

A characteristic feature of the cyanosis, in many cases, was the entire absence of subjective distress and air hunger. Stupor and delirium were common symptoms in severe cases. The delirium was of two types: the active, violent form which required unceasing watchfulness, and the quiet, muttering type which was accompanied by the other usual signs of the "typhoid" state.

While leukopenia was not quite so universal as in simple influenza, it nevertheless was present throughout the pneumonia in the majority of cases, and often was very pronounced. Counts of 3,000 or less were not so very infrequent.

Duration: The average length of life in fatal cases, from the time of recognition of the pneumonia, may be stated as between four and five days, and from the onset of the influenza, as from seven to ten days. Among the patients who recover, the average length of the febrile period is somewhat longer.

Fulminant cases: Special reference should be made to a remarkable clinical type which, in a few camps, notably at Camp Sherman, was sufficiently common to form an outstanding feature of the epidemic. The patients, even on admission to the hospital, showed extreme cyanosis, high fever and intense air hunger, and died in from twenty-four to forty-eight hours. The chest was filled with coarse, bubbling râles, and pinkish, frothy serous fluid often poured from the mouth and nostrils. The postmortem findings in the lungs were those of intense congestion and edema, without actual pneumonia. Friedlander[2] compares the

1. Chickering, H. T., and Park, J. H.: Staphylococcus Aureus Pneumonia, J. A. M. A. **72**: 617 (March 1) 1919.

2. Friedlander, Alfred; McCord, C. P.; Sladen, F. J., and Wheeler, G. W.: The Epidemic of Influenza at Camp Sherman, Ohio, J. A. M. A. **71**: 1652 (Nov. 16) 1918.

clinical picture to that seen after severe exposure to chlorin gas.

Other Respiratory Complications.—Severe acute laryngitis, sometimes with ulceration, was a not uncommon complication in the pneumonia cases.

A certain proportion of influenza patients, instead of having only a mild bronchitis, develop a severe, purulent form which may last for weeks or months and may be associated with multiple, small bronchiectases.

Pulmonary Abscess.—The suppurative processes which frequently complicate the pneumonia of influenza seem to result chiefly, if not entirely, from the action of *Streptococcus hemolyticus* and *Staphylococcus aureus.* Such abscesses are usually small and multiple and are much more frequently found at necropsy than recognized during life. Solitary, large abscesses are rare.

Pleurisy and Empyema.—In general, in influenzal pneumonia, all forms of pleurisy were noticeably rare in cases of pneumococcal origin; and, except in hospitals in which streptococcus cases were numerous, pleural complications were much less frequent than we are wont to expect in primary pneumonia.

In the streptococcus cases, however, the pleura is extremely prone to infection, and empyema, either free or sacculated, was common. An important type clinically was the small, interlobar empyema, so difficult often to recognize, and so frequently mistaken for unresolved pneumonia. The incidence of empyema among the pneumonia cases probably did not average more than 5 per cent.

Subcutaneous Emphysema.—A remarkable but rare complication, a few examples of which were encountered at almost every camp, was extensive, subcutaneous emphysema. It was usually seen in cases of severe pneumonia, and appeared first either in the episternal notch or above the clavicles, extending thence rapidly

to the neck, face, scalp, chest, arms and trunk and, sometimes, to the scrotum. The prognosis in such cases seemed to depend rather on the severity of the pneumonia than on the existence of the emphysema. Such emphysema has been proved not to be due to gas bacillus infection. The mechanism of its production is discussed by Berkley and Coffen.[3] In most cases, certainly, the air finds its way to the subcutaneous tissue by the rupture of air vesicles and by passing thence along the vessel sheaths to the hilum of the lung and to the superior mediastinum. In both of two cases with this complication coming to necropsy at the base hospital at Camp Jackson, the lungs showed *Staphylococcus aureus* infection, with multiple miliary abscesses, most numerous just beneath the pleura.

In a few instances the emphysema has been associated with a pneumothorax.

Serious heart complications were conspicuously rare, even in the pneumonia cases. The severer forms of arrhythmia, such as auricular fibrillation and heart block, were occasionally observed, and rarely a pericarditis was found, sometimes during life but usually only at the necropsy table.

The persistent tachycardia, so frequently seen during convalescence from influenza, seems to be a purely functional disorder, belonging to the category of the so-called irritable heart of soldiers, and related to the general asthenic state rather than to any actual heart damage. There is no reason whatever to believe that it indicates a myocarditis or myocardial degeneration. Its tendency is wholly in the direction of complete, if gradual, recovery. This tendency may be largely nullified, however, by the unwise policy, on the part of the physician, of permitting the patient to believe he has some serious heart disorder which demands the strict avoidance of exercise and exertion.

3. Berkley, H. K., and Coffen, T. H.: Generalized Interstitial Emphysema and Spontaneous Pneumothorax, J. A. M. A. 72: 535 (Feb. 22) 1919.

Thrombophlebitis. — This was an infrequent, but important, complication. It usually involved the leg veins and was associated, in an unusually large proportion of the cases, with fatal pulmonary embolism.

A very few instances of thrombosis of the arteries of the leg, with gangrene, are recorded.

Complications Referable to the Nervous System.— Of these, the most important, meningitis, seems to have occurred only in the cases complicated by pneumonia, and even in these cases was comparatively rare, although a considerable number of instances have been recorded. At Camp Jackson, among eighteen cases of meningitis complicating influenza, thirteen were caused by the meningococcus, four by the pneumococcus and one by the staphylococcus.

The types of delirium seen among the pneumonia cases have been referred to. Mental depression, in the frequent cases of slow and tedious convalescence, was often pronounced, and sometimes amounted to a true psychosis with suicidal tendencies. In general, however, the psychoses belong rather to the sequelae than to the complications of influenza and, as such, are beyond the scope of this paper. The relation to influenza of such organic nervous diseases as lethargic encephalitis and epidemic polyneuritis is still obscure and uncertain.

Complications referable to the gastro-intestinal tract are few and infrequent. Inflammation of the parotid gland was occasionally seen among the severe pneumonias. Jaundice, even in the pneumonia cases, was very infrequent. Marked tympanites was a frequent and dreaded symptom among the severe pneumonias.

A few instances of peritonitis, generally of pneumococcal origin, have been reported. Most of these were localized in the diaphragmatic region or the upper abdomen. In a very few instances the peritonitis was general.

Arthritis.—As a complication, arthritis was rare. Occasionally a pneumococcal arthritis was seen in cases complicated by pneumonia.

Disturbances of the kidneys, as has been said, formed no part of the clinical picture of simple influenza. In a few of the cases complicated by pneumonia, evidences of nephritis appeared; but such cases were rare and the nephritis usually mild in type.

Inflammation of the Middle Ear.—This is classed, in most reports, as an infrequent complication. Figures are available from one base hospital (Camp Hancock) in which systematic and regular examinations of the ears of all influenza patients were carried out. Among 7,800 cases of influenza, an otitis media sufficiently pronounced to call for incision of the drum was found 300 times, or in about 4 per cent. of the cases. Among these 300 cases of otitis, a mastoiditis of sufficient severity to demand operation occurred only four times. There is much testimony to the effect that, in most camps, mastoiditis was a rare complication of influenza.

Inflammation of the Accessory Sinuses.—This was, clinically speaking, a very infrequent occurrence. Only rarely were frank examples of frontal or maxillary sinusitis encountered; but the postmortem findings in patients dying of pneumonia told a very different story. In these fatal cases, purulent inflammation of the sinuses was very commonly found. Among fifty-five necropsies at the base hospital at Fort Riley,[4] the sphenoidal sinus was shown to be involved in 68 per cent., the ethmoidal sinus in 31, and the mastoid cells in 41. The frontal sinus was affected in only two cases.

COMPARISON OF RECENT EPIDEMIC WITH THAT OF 1889-1890

For one who, as a hospital intern, had a personal experience with the influenza epidemic of 1889-1890, it is interesting to review the clinical features of that

4. Stone, W. J., and Swift, G. W.: Influenza and Influenzal Pneumonia at Fort Riley, Kansas, J. A. M. A. **72**: 487 (Feb. 15) 1919.

epidemic and to compare them, one by one, with those of the recent pestilence. After such a review no one can, I think, have the least doubt as to the identity of the two epidemics. Not only is there a striking similarity in the modes of onset and in the symptoms of the disease proper, but, in the tendency to special complications, and in particular to pneumonia of an unusual type, the resemblance is extremely close. All the well known diagnostic features of the present epidemic find their counterparts among those of the earlier one; the abrupt onset, the prostration, the pains, the injected conjunctivae and painful eyes, the characteristic skin rashes, the prevalence of respiratory symptoms—all these are features common to both epidemics.

Certain differences, chiefly of degree, can be noticed, however. The virulence of the recent epidemic was unquestionably greater. A larger proportion of the population seems to have been attacked; the incidence of pneumonia has been greater, and its mortality has also been somewhat greater, apparently.

Examples of the so-called cerebral and gastro-intestinal types of influenza, concerning which much was said and written in the earlier epidemic, have been so rare in the present one as to raise a question as to the propriety of such a classification. In the present epidemic there has been, for all practical purposes, only a single type—the respiratory.

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STUDIES IN INFLUENZA AND PNEUMONIA

IV. FURTHER RESULTS OF PROPHYLACTIC INOCULATIONS *

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To determine the value of vaccination against disease, it is essential that the disease shall be one which a relatively large number of persons will develop unless protected, and that it be accompanied by serious consequences. These conditions were amply fulfilled during the pandemic of influenza. Moreover, the vaccine should contain the killed bacteria that produce symptoms and which are at least contributory to the cause of death. We have attempted, so far as possible, to fulfil this requirement by making a careful bacteriologic study of the disease, and by incorporating into the vaccine the important bacteria isolated. The epidemic was severe, and the need and the demand for vaccination were great; a large number of cases were available for bacteriologic study and to supply the proper strains for the vaccine. Vaccinations in large numbers during the past ten years with bacteria belonging to the group found in influenza have at least proved harmless, and in the case of pneumonia, prophylactic vaccinations have been successfully carried out by Wright,[1] Lister,[2]

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1. Wright, A. E.; Morgan, W. P., et al.: Observations on Prophylactic Inoculation Against Pneumococcus Infections and on the Results Which Have Been Achieved by It, Lancet 1: 1-10 (Jan. 3) 1914.

2. Lister, F. S.: Prophylactic Inoculation of Man Against Pneumococcal Infections and More Particularly Against Lobar Pneumonia; Including a Report on the Results of the Experimental Inoculation, with a Specific Group Vaccine, of the Native Mine Laborers Employed on the Premier (Diamond) Mine and the Crown (Gold) Mines in the Transvaal and the de Beers (Diamond) Mines at Kimberley—Covering the Period from Nov. 1, 1916, to Oct. 31, 1917, Publications of the South African Institute for Medical Research, Johannesburg, South Africa, W. E. Hortor and Company, Ltd., 1917, pp. 1-30.

and Cecil and Austin.[3] A splendid opportunity to study the effect of prophylactic inoculation was at hand. Owing to the foresight of the founders of the Mayo Foundation, necessary funds to meet the emergency were available. A large amount of the vaccine has been prepared and sent gratis on request to numerous physicians on condition that reports of the results be returned.

In a previous report,[4] the reasons for the use of a mixed vaccine containing, as far as possible, freshly isolated strains were discussed. It was pointed out that the streptococci, especially green-producing streptococci from influenza, have certain peculiar properties. The preliminary results, as reported from the use of this vaccine, indicate that considerable protection is afforded against influenza and especially against the accompanying pneumonia. Vaccinations were begun soon after the onset of the epidemic. The period of observation was six weeks. It is our purpose in this paper to emphasize essential points in the preparation of the vaccine, to present further results from its use, and to record certain immunologic experiments.

COMPOSITION AND PREPARATION OF THE VACCINE

Influenza bacilli were isolated in large numbers at the outset of the epidemic, but they were rarely found later in the epidemic. The small fraction of influenza bacilli included in the first few batches of vaccine were therefore omitted, and the vaccine was made to contain a proportionately higher percentage of the green-producing streptococci. In other respects, the original formula has been adhered to. The formula as used in almost all cases covered by the present report is given in Table 1.

The preparation of the medium, the method of cultivating and collecting the bacteria, and the procedure

3. Cecil, R. L., and Austin, J. H.: Prophylactic Inoculation Against Pneumococcus, J. Exper. M. 28: 19-41 (July 18) 1918.

4. Rosenow, E. C.: Prophylactic Inoculation Against Respiratory Infections: Preliminary Report, J. A. M. A. 72: 31-34 (Jan. 4) 1919.

of standardizing the dose and killing the bacteria are described in the preliminary report.[4] The vaccine, it will be remembered, was made to contain approximately 5 billion bacteria for 1 c.c. Later, the concentration was made twice as great, and the quantity of

TABLE 1.—FORMULA OF VACCINE

Pneumococci, Types I (10 per cent.), II (14 per cent.), and III (6 per cent.)	30 per cent.
Pneumococci Group IV and the allied green-producing diplostreptococci described	40 per cent.
Hemolytic streptococci	20 per cent.
Staphylococcus aureus	10 per cent.

liquid was reduced to one-half. The injections were given subcutaneously one week apart. The first dose of the concentrated vaccine (0.25 c.c.) contained 2.5 billion, the second (0.5 c.c.) 5 billion, and the third (0.75 c.c.) 7.5 billion bacteria. Considering the large size of these doses and the reactions obtained, the injections should not be given oftener than once a week in order not to overstimulate the mechanism of immunity.

The tendency of streptococci to undergo changes and to lose specific properties has been repeatedly emphasized by one of us. It was thought important that freshly isolated strains should be included in the vaccine. In Table 2 are given the culture generations

TABLE 2.—CULTURE GENERATION OF BACTERIA FROM INFLUENZA AS USED IN THE VACCINE

Cultures	Green-Producing Streptococcus	Hemolytic Streptococcus	Staphylococcus
Third generation or below	58	18	18
Fourth to tenth generation	95	20	8
Eleventh to twentieth generation	21	0	0
Total	174	38	26

of all the strains that have been used throughout the epidemic. The fermentation power was tested of fifty-seven strains of the green-producing streptococci included in the vaccine; only twenty-seven fermented inulin, and only eight were bile soluble.

The advantages which should come from the use of a lipovaccine, particularly when a series of strains needs to be included, have already been pointed out, and a simple method for the preparation in oil of a vaccine of the formula given in Table 1 has been developed and submitted for publication. A further study of the sputum and other material shows that of all the bacteria isolated, the somewhat peculiar green-producing streptococcus or diplostreptococcus is the most important. This organism is present in large numbers at the very outset of symptoms of influenza and of the accompanying pneumonia; it is commonly present after death. If the sputum or mass cultures are injected intraperitoneally into animals, they die, usually from invasion of the green-producing streptococci or pneumococci. If injected intratracheally in guinea-pigs the picture of influenzal pneumonia is closely simulated. Immunologic experiments with the serum from a horse injected with one strain indicate that most of the strains are immunologically alike. The serum of cases of influenza develops agglutinating power over these strains.

AGGLUTINATING POWER

In Table 3 it is shown that the vaccine used possessed well marked antigenic powers. The strains S 1, S 3, 2598².2, 2604.2, 3048.3, and 2874².3 were green-producing streptococci or pneumococci; 2575.2, a hemolytic streptococcus, and 2608³.2, a staphylococcus from cases of influenza. It will be noted that agglutinins appear in the serum on the tenth day and persist for six weeks. Table 3 shows, moreover, that the bacteria in the vaccine (492) used as the antigen in the first column were susceptible to agglutination. This vaccine was prepared three months previously and was kept in the ice chest. Most of the strains used as antigen in the experiment recorded in this table were not included in the vaccine used to immunize

TABLE 3.—AGGLUTINATING POWER OF THE SERUM OF PERSONS INOCULATED WITH SALINE VACCINE

Serums (Dilutions 1:20)	Strains								
	492	S 1	S 8	2,598[3].2	2,604.2	3,048.3	2,874[3].3	2,575.2	2,608[3].2
2,542 24 hours before third dose saline vaccine	0	0	0	0	0	+	+	0	0
2,542 24 hours after third dose saline vaccine	0	0	0	0	0	+	+	0	0
2,542 48 hours after third dose saline vaccine	0	0	0	0	++	++	++	0	0
2,542 10 days after third dose saline vaccine	+	++	+	0	++	++	+++	++	0
2,542 6 weeks after third dose saline vaccine	+	++	..	..	++	..	..	..	0
2,543 24 hours before third dose saline vaccine	0	0	0	0	+	0	0	0	0
2,543 24 hours after third dose saline vaccine	0	0	0	0	+	0	0	0	0
2,543 48 hours after third dose saline vaccine	+	0	0	0	++	0	++	0	0
2,543 10 days after third dose saline vaccine	++	+	0	0	++	++	+++	+	+
2,543 6 weeks after third dose saline vaccine	++	+	0	0	+++	++	++	+	0
2,545 24 hours before third dose saline vaccine	0	0	0	0	0	0	0	0	0
2,545 24 hours after third dose saline vaccine	0	0	0	0	0	0	0	0	0
2,545 48 hours after third dose saline vaccine	0	0	0	0	+	0	0	0	0
2,545 10 days after third dose saline vaccine	++	0	0	0	++	++	++	++	++
2,545 6 weeks after third dose saline vaccine	++	0	0	+	++	++	++	++	++
2,547 24 hours before third dose saline vaccine	0	0	0	0	0	0	0	0	0
2,547 24 hours after third dose saline vaccine	0	0	0	0	0	0	0	0	0
2,547 48 hours after third dose saline vaccine	+	0	0	0	+	+	+++	0	0
2,547 10 days after third dose saline vaccine	++	0	+	+	++	++	++	0	0
2,547 6 weeks after third dose saline vaccine	++	0	+	+	++	++	++	0	++
3,075 normal	0	0	0	0	0	0	0	0	0
3,076 normal	0	0	0	0	0	0	0	0	0
NaCl	0	0	0	0	0	0	0	0	0

the persons whose serums were tested. All the green-producing streptococci were agglutinated, however, by the monovalent horse serum.

TABLE 4.—AGGLUTINATING POWER OF THE SERUM OF PERSONS INOCULATED WITH LIPOVACCINE

Serums (Dilutions 1:20)	Strains						
	3,271[2].3	3,296[2].2	3,331	3,332.2	3,334.2	3,334.2	3,342
3,074 normal	0	++	+	+	0	++	0
3,074 4 days after lipovaccine	+	+++	++	++	+	++	0
3,074 10 days after lipovaccine	+++	++++	+++	++	++	+++	0
3,074 6 weeks after lipovaccine	++	+++	++	+	+	++	0
3,075 normal	0	++	0	0	+	0	0
3,075 4 days after lipovaccine	++	+	0	0	+	++	0
3,075 10 days after lipovaccine	+	++++	+	+	++	++	0
3,076 normal	0	++	+	0	0	0	0
3,076 4 days after lipovaccine	+	+++	+	0	+	0	0
3,076 10 days after lipovaccine	++	+++	++	0	+	0	0
3,076 6 weeks after lipovaccine	+++	++++	+	0	++	0	0
NaCl	0	0	0	0	0	0	0

In Table 4 are given the results following the injection of a single dose of the lipovaccine (from 25 to 75 billions) in three persons. It may be noted that the amount of agglutination is greater than that following the injection of the saline vaccine, but here, as in the case following the injection of the saline vaccine, not all strains are equally susceptible to agglutination, and some are not agglutinated at all.

Table 5 shows the agglutinating power of various immune horse serums over strains of green-producing streptococci from influenza, strains included in the vaccine. The serum from Horse 15, immunized with one strain from the blood of a patient who died, has marked agglutinating power over most of the strains. Of the thirty-three strains tested in this manner, twenty-five were agglutinated specifically by this serum. The results indicate clearly that among the green-producing streptococci, including Group IV pneumococci in influenza, there are strains which have a specific

TABLE 5.—AGGLUTINATING POWER OF VARIOUS IMMUNE HORSE SERUMS OVER STREPTOCOCCI INCLUDED IN THE VACCINE

Serums (Dilutions 1:20)	Strains														
	2,347.19	2,349.13	2,350.16	2,581.14	2,582.4	2,584.11	2,557.2	2,604.2	2,618[2].2	2,684.16	2,698[2].3	2,719[2]	2,769	2,800[2].2	2,825
Pneumococcus Type I....	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0
Pneumococcus Type II...	++	0	0	+	0	+	0	0	0	++	0	0	0	0	0
Pneumococcus Type III..	0	0	0	+	0	+	0	0	0	0	0	0	0	0	0
Horse 9.....	++	++	0	+	0	++	0	0	0	0	0	+++	0	0	++
Horse 15.....	++++	+++	++++	++++	+++	++++	0	+++	++++	++	++++	++	0	++	+++
Normal horse.....	0	0	0	+	0	+	0	0	0	0	0	0	0	0	0
NaCl.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 6.—RESULTS AS REPORTED IN QUESTIONNAIRES FROM ALL SOURCES

Groups	Total Number	Incidence for 1,000 Persons									
		Disease				Deaths					
		Influenza	Acute Edema of Lungs	Pneumonia	Empyema	Acute Edema of Lungs	Pneumonia	Empyema	Meningitis	Encephalitis	Total Deaths
Vaccinated once...	26,936	118.2	3.1	8.7	0.29	0.14	2.6	0.07	0.18	....	3.0
Vaccinated twice..	23,348	97.0	0.77	3.04	0.17	0.47	1.9	0.04	0.21	....	2.62
Vaccinated 3 times	93,476	87.9	0.8	4.4	0.18	0.18	1.2	0	0.05	....	1.43
Not vaccinated....	345,133	281.8	4.4	21.0	0.83	1.7	2.37	0.07	0.15	0.08	8.55

relationship, and that we were fortunate in successfully separating them from the ordinary *Streptococcus viridans* and including them in the vaccine long before the results of immunologic experiments were available.

The apparent protection against attacks of influenza noted in the preliminary report, difficult to understand at that time, now becomes rational.

METHOD OF SECURING DATA

In most instances the reactions were mild, about one person in each 100 reacted more severely. Some reacted severely to all three inoculations, others only to one or two. Persons coming down with a cold or with symptoms of influenza are often hypersensitive. Marked diffuse redness resembling erysipelas about the site of inoculation, with swelling and, later, marked induration, has occurred occasionally. In no instance were the symptoms alarming. The number of severe reactions is sufficiently large, however, to prevent general vaccination except at the time of an acute emergency. This is in accord with the experience of Cecil and Austin,[8] noted during prophylactic inoculations with pneumococci. An outline for records of persons vaccinated was sent with each batch of vaccine and later a questionnaire. The questionnaire asked for the date of the onset of the epidemic, the date when the vaccine was first used, the week of the height of the epidemic, the week in which the greatest number of vaccinations were given, and the duration of the epidemic. The number of cases of influenza from the time the vaccinations were begun until the end of the epidemic, or up to May 1, and the number of deaths which occurred among the vaccinated and unvaccinated in the same period, in the practices of the physicians supplied with the vaccine, were asked. The reports of the use of the vaccine after the epidemic had disappeared were excluded. The period of observation in most instances was from four to five months.

In determining a safe criterion as to the value of the vaccine, we have purposely been unfair to the vaccinated group. The protection afforded among the vaccinated patients was measured from the day of the first vaccination, whereas, judging by the agglutination experiments, it should be calculated from about one week after the third injection.

There is another reason why we have arbitrarily decided to make our calculations from the day of the first vaccination. A procedure, calculated to protect against an epidemic disease, such as influenza, should have sufficient protective value when given after the onset of the epidemic to be measurable, for it is practically impossible to anticipate these epidemics and, moreover, persons will not present themselves for vaccination until the epidemic is at hand.

The questionnaire was arranged so as to yield information regarding the incidence of influenza, acute edema of the lungs, pneumonia and empyema, and the deaths from acute edema of the lungs, pneumonia, empyema, meningitis, and encephalitis among the vaccinated and the unvaccinated. Separate reports including the foregoing points were asked for from institutions and in the cases of pregnant women. The impressions gained from the use of the vaccine regarding the severity of the disease if contracted following vaccination, and the effect, if any, which the vaccine had on certain chronic infections, such as bronchitis, sinusitis, myositis, and arthritis were asked for.

Many physicians were so overwhelmed during the height of the epidemic that accurate records could not be kept, and accordingly the reports containing accurate data are proportionately few. The reports of 530 physicians were fairly complete, however, and these are summarized in Table 6. It is realized that there must necessarily be errors in the morbidity figures as reported to us, just as in the case of reports to boards of health. It is generally agreed that as influenza became more prevalent and less severe, a proportion-

ately smaller number of cases were reported, and that all morbidity figures reported are well below the actual figures. The error, however, among the vaccinated and unvaccinated groups in the reports to us, should be approximately the same, and hence the figures should be comparable. Mortality figures, on the other hand, may be considered as fairly accurate.

RESULTS OF INOCULATION

The total number of unvaccinated persons recorded in Table 6 represents the sum of the estimated clienteles of the various physicians reporting the cases, and averages about 1,200 for each. It will be noted that the incidence of influenza, of acute edema of the lungs, of pneumonia following influenza, and the number of deaths from all causes among the vaccinated are consistently lower than that among the unvaccinated. Moreover, the incidence of disease and deaths is lowest in the group of 93,476 persons who were vaccinated three times. The reports included in this table were from many states, but the largest number came from Iowa, Minnesota, and Wisconsin. Thirteen thousand, six hundred and fifty persons inoculated and 2,083 who died were grouped according to age by decades. The curves indicating the percentage in each run roughly parallel.

The largest number of inoculations were given and the largest number of deaths occurred between the ages of 11 and 40 years. The percentages of the former in these three decades were 23, 19, and 21, of the latter 13, 29, and 23, respectively. Through the cooperation of the Board of Health of Minnesota we were able to check the results as reported to us with the morbidity and mortality figures as reported to them. Reports on a considerable number of vaccinations were received from Brown, Chippewa, Clay, Dodge, Fillmore, Goodhue, Houston, Itasca, Lesueur, Lyon, Mower, Olmsted, Rice, Stearne, Steele, Wabasha, Waseca, Watonwan, and Winona counties. The total

TABLE 7.—RESULTS AS REPORTED IN QUESTIONNAIRES FROM NINETEEN COUNTIES IN MINNESOTA EXCLUSIVE OF THE MAYO CLINIC

Groups	Total Number	Incidence for 1,000 Persons — Disease: Influenza	Disease: Acute Edema of Lungs	Disease: Pneumonia	Disease: Empyema	Deaths: Acute Edema of Lungs	Deaths: Pneumonia	Deaths: Empyema	Deaths: Meningitis	Deaths: Encephalitis	Total Deaths
Vaccinated once...	4,828	115.1	0.4	8.28	0	0	0.2	0	0	0	0.2
Vaccinated twice..	4,029	88.3	0.74	3.7	0.47	0.47	1.9	0	0.47	....	3.2
Vaccinated 3 times	17,582	102.8	0.17	4.2	0.22	...	0.62	....	....	....	0.8
Not vaccinated....	36,100	373.5	1.35	20.4	0.6	1.4	4.0	0.13	0.16	0.02	6.35
As reported to State Board of Health..... (Estimated population)	472,584	65.3	....	....	....	....	....	....	....	....	3.2*

* Exclusive of deaths which occurred prior to the use of the vaccine and exclusive of the Mayo Clinic cases.

TABLE 8.—RESULTS IN OLMSTED COUNTY EXCLUSIVE OF MAYO CLINIC AND STATE HOSPITAL FOR INSANE

Groups	Total Number	Incidence for 1,000 Persons — Disease: Influenza	Disease: Acute Edema of Lungs	Disease: Pneumonia	Disease: Empyema	Deaths: Acute Edema of Lungs	Deaths: Pneumonia	Deaths: Empyema	Deaths: Meningitis	Deaths: Encephalitis	Total Deaths
Vaccinated once...	2,424	100.2	0	6.1	0	0.41	2.8	0	0	0	3.2
Vaccinated twice..	1,021	291.8	2.9	0	1.9	0	4.8	0	1.9	....	6.7
Vaccinated 3 times	9,300	41.0	0.18	3.9	0.43	....	0.43	0.21	....	....	0.64
Not vaccinated....	8,700	248.0	3.2	13.1	0.45	0.9	2.6	0.45	0.12	....	4.0

estimated population of these counties is 472,584. The total number of cases of influenza in these counties reported to the board of health from the beginning of the epidemic until May 1 is 30,763, or sixty-five for each thousand. This is admittedly a low figure. The total mortality rate as reported to the board of health during this time is 4.2. The mortality rate, excluding the deaths which occurred in the respective counties prior to the date of the first vaccinations, is 3.2 (Table 7). The figures in the table indicating the cases and the deaths as reported to us are believed to be more accurate. The mortality rate, exclusive of that of the Mayo Clinic, in the 17,532 persons vaccinated three times is only one fourth of that reported to the board of health. Moreover, the total number of deaths among the vaccinated, including the persons inoculated only once and twice, is 1.6 for 1,000, or half the mortality rate as reported to the board of health during the same period of time. When we consider the fact that the deaths in each group were counted from the time the first vaccinations were given, which is really unfair to the vaccine, and the fact that our figures include all pneumonias, while those of the board of health include only the influenzal pneumonias, there seems little doubt that the difference must be due to the protection afforded by the vaccine. The figures given in Table 8 for Olmsted County, where about one third of the population was vaccinated, exclusive of the Mayo Clinic and the state hospital, are similar to those obtained elsewhere. The incidence of disease and the death rate among those vaccinated three times are well below that of those not vaccinated.

The results obtained in institutions in which the conditions among the vaccinated and the unvaccinated were comparable are summarized and given in Table 9 in order still further to check the figures. The number of persons in most of the institutions included (fifty-

three in all) was small. The opportunity for accurate observation was, therefore, favorable. The institutions included factories, personnel of hospitals, schools, and offices. The proportion of the vaccinated and unvaccinated varied between wide limits. The period of observation in the two groups was the same. The incidence of disease and the number of deaths in almost all instances were lower in the vaccinated than in the unvaccinated group. The total average, as given in Table 9, compares favorably with that of the others. The death rate among the vaccinated is decidedly lower than among the unvaccinated.

TABLE 9.—RESULTS OF PROPHYLACTIC INOCULATION IN INSTITUTIONS WHERE THE CONDITIONS AMONG THE VACCINATED AND UNVACCINATED WERE COMPARABLE

		Incidence for 1,000 Persons					
		Disease				Deaths	
Groups	Total Number	Influenza	Acute Edema of Lungs	Pneumonia	Empyema	Acute Edema of Lungs	Pneumonia
Vaccinated 3 times	8,306	31	0.1	1.0	0.2	0	0.5
Not vaccinated....	9,388	200	0.5	12.0	0.6	0.4	5.5

The results given in the tables are in agreement with the numerous reports received by which it appeared that the vaccine had afforded striking instances of protection. In a few cases no protection seemed to be afforded, but in most of these the vaccinated persons contracted the disease a long time after the inoculations. It is fully realized how difficult it is to judge just how much protection was conferred in many of these instances, and how much of the apparent protection was merely coincidental. But a careful study of the reports from 303 physicians, some of which were the result of careful observation, forces the conviction that real protection, especially against pneumonia, was afforded. In some of these instances most of the observations were made within six weeks to two months after the vaccine was given.

It was thought that the injection of large doses of a mixed vaccine might have some effect on certain

chronic infections, especially of the respiratory tract. A summary of the reports shows that 961 persons with chronic bronchitis were benefited and that thirty-eight were made worse. The reports show that 127 persons with chronic sinusitis were benefited and four made worse. Improvement was noted in 121 persons having myositis and in 129 with arthritis, while in one of the former and in twenty-two of the latter the symptoms were aggravated. These figures are not considered to be especially significant but worthy of record. They are in accord with our own observations.

RESULTS OF PROPHYLACTIC INOCULATION IN PREGNANCY

The results of vaccinations in pregnant women as reported in the questionnaires are summarized in Table 10. The incidence of disease and that of miscarriages and the mortality rate are consistently lower among those vaccinated than among those not vaccinated. The mortality (20 per cent.) of the unvaccinated pregnant women who developed influenza is somewhat lower than that reported from similar statistical studies by Bland[5] and by Harris.[6] They report a mortality of 37.7 per cent. and 27 per cent., respectively. The mortality of 12 per cent. in the 997 pregnant women inoculated in our series is in sharp contrast and calls for a further trial of this measure.

Almost from the beginning of the epidemic of influenza, patients who registered at the Mayo Clinic were advised to be vaccinated. From October 1 to May 1, 55,189 patients registered. Of these, 2,542 were vaccinated once, 1,030 twice, and 1,850 three times, a total of 5,422. A reliable morbidity and mortality rate for each thousand of the vaccinated and unvaccinated could not be determined because such a large percent-

5. Bland, P. B.: Influenza in Its Relation to Pregnancy and Labor, Am. J. Obst. **79**: 184-197 (Feb. 19) 1919.
6. Harris, J. W.: Influenza Occurring in Pregnant Women, J. A. M. A. **72**: 978-980 (April 5) 1919.

TABLE 10.—RESULTS OF PROPHYLACTIC INOCULATION IN PREGNANCY

Groups	Total Number	Incidence for 1,000 Persons — Disease: Influenza	Disease: Acute Edema of Lungs	Disease: Pneumonia	Disease: Empyema	Disease: Miscarriage	Deaths: Acute Edema of Lungs	Deaths: Pneumonia	Deaths: Empyema	Deaths: Meningitis	Deaths: Total Deaths	Mortality of Those Who Developed Influenza
Vaccinated 3 times	997	109.3	17.0	27.0	....	14.0	2.0	12.0	....	....	14.0	12 per cent.
Not vaccinated....	3,656	294.6	17.7	80.4	0.82	46.2	12.3	46.2	0.54	0.82	59.9	20 per cent.

age of patients remained in Rochester for too short a time.

It was thought that a study of the cases of influenza admitted to the hospitals might, however, be worth while. Of these, 749 were undoubted cases of influenza, and were analyzed from various standpoints. Fifty-nine of the patients were vaccinated once; twenty-four, twice, and fifty-seven, three times, while 609 were not vaccinated. The incidence of pneumonia and the deaths from pneumonia in these groups are recorded in Table 11. The average interval between

TABLE 11.—RESULTS IN CASES OF INFLUENZA ADMITTED TO HOSPITALS IN ROCHESTER

Groups	Cases of Influenza	Incidence of Pneumonia	Deaths from Pneumonia, per Cent.
Vaccinated once	59	39	10
Vaccinated twice	24	95	12
Vaccinated three times	57	21	5
Not vaccinated	609	57	22

the vaccinations and the onset of influenza was nine days in those vaccinated only once, twenty-six days in those vaccinated twice, and forty-five days in those vaccinated three times. The average temperature was more than one degree higher in the unvaccinated than in the vaccinated, and the average duration of fever nearly two days longer. The percentage incidence of pneumonia in those vaccinated three times was 21; in those not vaccinated, 57, while the percentage of deaths from pneumonia was 5 in the former group and 22 in the latter. The mortality from pneumonia of those vaccinated only once and those vaccinated twice is also well below that of the unvaccinated. The mortality figure in the unvaccinated is abnormally high because only the patients with relatively severe attacks were admitted to the hospitals.

The greater tendency to the development of pneumonia in influenza among the unvaccinated group as observed in this series is in keeping with the lower incidence of this complication (4.7 per cent.) in 11,325

cases of influenza in which the vaccine was given after the onset of the symptoms, as compared with the incidence (8.7 per cent.) in 41,788 cases in which the vaccine was not used. The average mortality in the cases in which the vaccine was used in treatment was 1.4 per cent.; in those not treated it was 2.1 per cent.

From these results considerable weight may be attached to the opinion of nearly all the 430 physicians who have used the vaccine and who have reported on this point, an opinion in agreement with our own observations, that is, that the attacks of influenza if contracted following vaccination are milder and of shorter duration.

SUMMARY

The immunologic and animal experiments reported[7] elsewhere indicate that the mixed vaccine used by us contained the important bacteria as they occur in influenza and the accompanying pneumonia, and that a relatively large number of strains of the green-producing streptococci which appear to have a specific relationship to the initial attack were included. The reports included results obtained under the most varied conditions, from many communities covering a wide range of territory. In some communities the mortality rate was excessively high, in others comparatively low. The number of persons inoculated is sufficiently large to make the statistical figures fairly accurate. The period of observation was from three to seven months. The incidence of influenza and pneumonia as reported to us is probably far from exact, but the percentage of error should be about the same in the vaccinated and unvaccinated groups. Indeed, if a difference exists, the number of cases reported among the vaccinated might be expected to be proportionately higher because, even though no protection was promised, the fact that

7. Rosenow, E. C.: The Experimental Production of Symptoms and Lesions Simulating Those of Influenza with Streptococci Isolated During the Present Epidemic, Study II, J. A. M. A. 72: 1604-1608 (May 31) 1919. The Occurrence of a Pandemic Strain of Streptococcus During the Pandemic of Influenza, Study III, ibid. pp. 1608-1609.

influenza occurred after the vaccinations were taken would naturally lead to a higher percentage of reports to the physician who gave the inoculations. The average incidence of influenza and pneumonia in the group inoculated three times is about one-third that of the uninoculated group.

The average mortality rate in the uninoculated, as reported to us, approximates the mortality rate (5.4 per cent.) of sixteen large cities of the United States as given in *Public Health Reports* for February 7. The average mortality rate in the group inoculated three times is about one-fifth that of the uninoculated. A definite although a smaller degree of protection appeared to be afforded to those who took only one or two inoculations. From a study of a series of hospital cases of influenza it is found that the tendency to the development of pneumonia in the vaccinated is about one third as great as among the unvaccinated, and that the mortality in the former is about one fifth as great as in the latter. The number of completed vaccinations in pregnant women is not large enough to give exact figures, but the results indicate clearly that a definite degree of protection was afforded in this group of individuals.

It appears from all the facts at hand that by the use of a properly prepared vaccine it is possible to rob influenza of some of its terrors.

The preliminary results from the use of more than 500 doses of this vaccine suspended in oil, the immunologic studies and the results from the use of pneumococcus lipovaccine reported by Fennel[8] and by Cecil and Vaughan[9] suggest strongly that both the degree of protection and the duration of the immunity may be materially increased by the use of lipovaccine over that reported in this paper from the use of the saline vaccine.

8. Fennel, E. A.: Prophylactic Inoculation Against Pneumonia, J. A. M. A. **71**: 2115-2120 (Dec. 28) 1918.

9. Cecil, R. L., and Vaughan, H.: Results of Prophylactic Vaccination Against Pneumonia at Camp Wheeler, J. Exper. M. **29**: 457-483 (June) 1919.

STATUS OF PROPHYLACTIC VACCINATION AGAINST INFLUENZA

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When we consider the tragic experience through which the country and, indeed, the world, has passed during the last year, we realize that a great advance in preventive medicine would be made by the discovery of a prophylactic agent which would enable health authorities to control effectively epidemic influenza or the pneumonia that so often occurs as a complication. Perhaps at the outset it may be profitable to take stock of what we know about the etiology of influenza and the etiology and pathology of influenzal pneumonias.

OPINIONS AS TO ETIOLOGY OF INFLUENZA AND INFLUENZAL PNEUMONIA

Though the organism described by Pfeiffer in 1891 has long been known as the influenza bacillus, there really never has been convincing evidence of its relation to influenza, and the data that accumulated during the epidemic or epidemics here and abroad this past year have not contributed any confirmation to the view that this germ is the cause of the disease.

In this connection it should be borne in mind that it is quite possible that there are a number of organisms, varying greatly in pathogenicity, which are grouped under the name of Pfeiffer's bacillus. We have only to recall the great differences that exist in other groups, in which organisms having common cultural and morphological characteristics vary greatly in

disease-producing properties, to realize that the rather vague limitations of what is called the influenza bacillus may cover a number of more or less closely related organisms.

French and English workers have claimed to have produced influenza by means of a filterable virus; this would, indeed, definitely eliminate Pfeiffer's bacillus; but we must bear in mind that attempts to produce the disease in man artificially in this country, by means of both filtered and unfiltered secretions, have in practically every instance been negative. Similar attempts by means of cultures of the so-called influenza bacillus have been negative.

When we turn to the views on the etiology and pathology of influenzal pneumonia, we find a rather general opinion that the pneumonia is due to Pfeiffer's bacillus or to the secondary invasion by organisms of acknowledged pathogenicity, particularly the various types of pneumococci, the streptococci, especially those known as hemolytic, and, less commonly, Friedländer's pneumobacillus or the staphylococcus.

A few observers are inclined to the opinion that the original cause of the influenza, be it the influenza bacillus or another organism, is also an essential factor in the production of the pneumonia. This view would appear to be entitled to much respect, on account of the rather general opinion among pathologists that the pneumonia following influenza is generally of a type distinct from the pneumonias ordinarily encountered.

A number of interesting papers have appeared on the pathology of influenzal pneumonia, and a complete review of them would be valuable; but, for the present purpose, we may say that, in general, the pneumonias do not conform to those due to the organisms which are usually associated with pneumonia. Lack of definite areas of consolidation, the absence of the usual fibrinous pleural exudate, the extreme wetness of the lungs, and the blood-stained pleural fluid usually found

bilaterally, in most cases serve to differentiate influenzal pneumonias from those ordinarily due to pneumococci, as lobar pneumonia. Emphasis is laid on this point because some workers have hoped that immunization against lobar pneumonia, which appears to be practicable, might prove of great value against influenzal pneumonia; but if the lung lesions of the two diseases are so different, one suspects there may be a material difference in etiology, and that this difference may be of such a nature as to make what appears to be a valuable prophylactic agent in one case of no use in the other.

Rosenow[1] calls especial attention to the fact that "the findings in the lungs, for example, in the so-called acute bronchopneumonia following influenza, are quite unique and are strikingly similar, irrespective of the species of microorganism present." This is quoted to emphasize the point that it is entirely possible that all of these lesions may be due to the primary cause of influenza, and that the various organisms which have been recognized in various cases and various places may really not reach even the dignity of secondary invaders, but may be looked on as leading a relatively saprophytic existence in the tissue damaged by the primary cause of influenza, whatever that may be. With this brief preliminary consideration of these important matters, let us consider the experience with prophylactic vaccination.

VACCINE FROM INFLUENZA BACILLUS AS A PROPHYLACTIC

In discussing this subject, we will give attention, first, to the results obtained from the use of a vaccine made from the influenza bacillus alone, or from other suspected etiologic agent, which aims, to be sure, to prevent the primary disease, and later to a review of the evidence with respect to vaccines which have been

1. Rosenow, E. C.: Prophylactic Inoculation Against Respiratory Infections, J. A. M. A. **72**: 31 (Jan. 4) 1919.

devised with the special object of preventing the development of pneumonia or of mitigating its severity.

A vaccine made from the influenza bacillus alone seems not to have appealed sufficiently to European workers to induce them to try it when the epidemic prevailed abroad. In this country, its use has been confined largely to New England. The early reports on this vaccine were very encouraging; figures were presented which, if taken at their face value, would convince any one of the efficiency of the agent; but, when these figures were submitted to careful analysis, much doubt remained as to whether the vaccine was of any service whatsoever. The chief source of error lay in the fact that the inoculations had been done during the progress of the epidemic, and that the case incidence among the vaccinated was compared with the case incidence in the general population or in the control groups from the beginning of the epidemic. Now, it is plain that if, after the epidemic is well under way, we vaccinate a portion of the persons in a population, the percentage of persons attacked will be smaller among the vaccinated than among the nonvaccinated, because a percentage of the total number of cases will have occurred before the vaccine is given. Not only does this introduce an error by counting in the control, or nonvaccinated group, cases that have occurred early, but also it leaves a select group to be vaccinated, wholly or in part, in which the percentage of susceptibles is smaller than in the original group of which they formed a part.

To make this clear, let us suppose that ten days after an epidemic started in a population of 1,000 persons, an admittedly worthless vaccine was administered to one half of those who at that time remained unattacked by the disease. Let us further assume that on the date of vaccination 20 per cent. of the population had sickened, leaving 800 well persons, of whom 400 were vaccinated. Since the hypothetical vaccine is worthless, the morbidity will be as great in

the vaccinated as in the nonvaccinated group. Let us assume this to be an additional 20 per cent. Then the total morbidity in the vaccinated group will be 20 per cent. of 400, or eighty cases. The total morbidity in the unvaccinated, however, if we consider the entire period of the epidemic will be 20 per cent. of 1,000, or 200, plus 20 per cent. of 400, or eighty, which would make 280 cases.

Although the error is now sufficiently clear, we have seen reports which, on the basis of the above figures, if applied to this hypothetical worthless vaccine, make it appear to be a valuable prophylactic. The statement of these reports would be, in effect, that one half of the population was vaccinated, that among the vaccinated only eighty cases developed, while among the unvaccinated 280 cases appeared. Hence the obvious value of the vaccine.

We must also remember that a vaccine can scarcely be expected to exert any appreciable prophylactic effect before from seven to ten days after the vaccine is given. since a week or more is required for immunity to develop. A comparison is fair which considers, among both vaccinated and nonvaccinated, only cases that have occurred, say, ten days or more after the vaccinations are made.

When the influenza bacillus vaccine was submitted to such critical tests as the inoculation of approximately half of the individuals in institutions, or in other large groups, its failure became apparent. A few examples of this are worth citing. Hinton and Kane[2] were able to vaccinate about half of the patients at an epileptic colony long enough before the disease became prevalent in the institution to justify the drawing of conclusions from their data. The vaccine used contained 800,000,000 organisms per mil, and a total of 2,000,000,000 were administered to each person. The results were as shown in Table 1.

2. The Commonwealth, Bimonthly Bulletin, Massachusetts State Department of Health 6:-28, Nos. 1 and 2, 1919.

TABLE 1.—EFFECT OF INFLUENZA BACILLUS VACCINE AS A PROPHYLACTIC

	Vaccinated		Not Vaccinated (Controls)	
	No.	Per Cent.	No.	Per Cent.
Number of persons	461	....	518	....
Cases of influenza	163	35.4	178	34.3
Deaths	28	17.0	24	13.5

On the basis of this experiment the authors reach the obvious conclusion that the vaccine was without value.

A similar test was made on the naval personnel at Pelham Bay Training Station; here a part of the individuals of a group were vaccinated, the remainder being held as controls. According to the latest available report,[3] 9 per cent. of the 554 inoculated persons developed the disease, and 5 per cent. of the 800 who had not been inoculated developed it.

Similar failure attended the attempts at immunization of men at the naval base at Paris Island, S. C. It was definitely shown that neither incidence nor severity was influenced by the vaccination. These observations were all on groups large enough to make the deductions of value.

A number of controlled vaccinations, in which influenza bacillus vaccine was used, carried out in institutions by the Public Health Service, gave the rather paradoxical result of showing an increased percentage of attacks among the vaccinated, but more deaths among the nonvaccinated. This result was obtained with a vaccine directed against the primary disease, not against the complicating pneumonia. The results are shown in Table 2. These figures illustrate the fallacy of giving much weight to the results of a small set of observations in work of this sort.

TABLE 2.—RESULTS OBTAINED BY INFLUENZA BACILLUS VACCINE IN INSTITUTIONS

	Vaccinated		Not Vaccinated (Controls)	
	No.	Per Cent.	No.	Per Cent.
Number of persons	484	....	842	....
Cases of influenza	153	31.6	223	26.4
Deaths	0	....	4	1.8

3. Notes on Preventive Medicine for Medical Officers, U. S. Navy bulletins, Nos. 50 and 51.

VACCINES FROM STREPTOCOCCUS AND OTHER ORGANISMS

Another series of vaccinations aimed directly against the supposed causative agent was that reported by Ely, Lloyd, Hitchcock and Nickson.[4] These workers believed that the epidemic was due primarily to a hemolytic streptococcus which could be detected in the blood and in the lungs. From the fact that the organisms with which these observers worked soon lost their chain-forming properties and, in some instances, the power to hemolyze promptly, they express some doubt as to whether they should be classed as streptococci, and they further assume that there are material differences between different strains. The results of the use of a vaccine prepared from organisms isolated from the cases were apparently most encouraging, though none of the experiments was controlled in a manner that would definitely establish the value of the preparation. The work of these observers needs to be repeated before the results can be accepted for general application.

When we come to consider the evidence with respect to the vaccines especially designed to prevent the pneumonic complications of influenza, we find again such conflicting reports that one is somewhat bewildered.

The only papers from a foreign source that have come to my notice are those by Eyre and Lowe,[5] who used a mixed vaccine which contained the pneumococcus, the streptococcus, the influenza bacillus, *Staphylococcus aureus, Micrococcus catarrhalis, B. pneumoniae* and *B. septus.*

These authors believe, and indeed present rather convincing figures in their first paper[5] to prove their point, that the use of this vaccine produces lowered resistance, which may last for "from a few hours to

4. Ely, C. F.; Lloyd, B. J.; Hitchcock, C. D., and Nickson, D. H.: Influenza as Seen at the Puget Sound Navy Yard, J. A. M. A. **72**: 24 (Jan. 4) 1919.

5. Eyre and Lowe: Lancet **195**: 484-487.

two or three weeks," during which period the incidence of respiratory infections would be increased among inoculated groups.

The early experience of the English authors does not refer directly to the prophylaxis of influenza, but it is cited here to show that there may be an element of danger in the indiscriminate use of vaccines in the presence of a rapidly spreading epidemic like influenza in which naturally many persons in the "negative phase" would be attacked.

In a later paper,[6] the same writers report on the experience with vaccine in the epidemic in England in the autumn of 1918. Stress is laid on the necessity of preparing a vaccine from cultures but recently isolated.

The figures given and the facts presented by these writers are difficult of interpretation and permit of almost any conclusion that one wishes to draw from them, from the optimistic one that fatalities after influenza occur only among the nonvaccinated, to the pessimistic one that fatalities occur only among the vaccinated, though the authors believe the results were good. They frankly reiterate the opinion that for a short time following vaccination there is an increased incidence among the vaccinated, owing to temporarily increased susceptibility, but the writers consider that this risk is justified by the benefit that they believe may accrue later. As inoculations were performed largely during the prevalence of the epidemic, and as the controls appear to include persons who developed the disease prior to the vaccination, the alleged good results may be misleading.

THE POLYVALENT VACCINE OF ROSENOW

Rosenow[1] prepared a mixed, and, at least in part, polyvalent, vaccine from the various fixed types of pneumococci, pneumococci of Group IV, hemolytic

6. Eyre and Lowe: Lancet **1918**: 553-560.

streptococci, *Staphylococcus aureus* and the influenza bacillus, all of which had been recently isolated. This vaccine was adjusted to meet the bacterial flora encountered during the epidemic; thus, in a manner it may be said that it was designed to approach an autogenous vaccine, but was intended primarily for prophylactic purposes. Dr. Rosenow felt that this vaccine should be prepared for use in any community from the strains of organisms there prevailing, and that a vaccine adjusted to meet the needs of one locality might not meet those of another. The figures given for protection are encouraging, but do not lend themselves to critical analysis.

Dr. Rosenow considers the immunity produced by his vaccine to be of relatively slight duration, as some persons were apparently protected during the first wave of the epidemic, but not during the second.

A vaccine, prepared essentially in accordance with Dr. Rosenow's formula, was used extensively in the Middle West with alleged good results, but it was not used until the epidemic was at, or beyond, the crest, and the records are not convincing. Vaccine prepared in the manner suggested by Dr. Rosenow should theoretically have a better chance for success than those we shall next consider, but the practical difficulties of preparing it from locally prevailing strains and adjusting it to meet the changing flora of the respiratory tract in a disease that spreads as rapidly as influenza are obvious.

A specimen of the vaccine which was being used in Illinois was tried in California, under rigidly controlled conditions, without success. The disease did not appear in the institution where the test was made until eleven days after the last injection, but, after the epidemic had swept through it, the results revealed that 37 per cent. of the vaccinated were attacked, against 28 per cent. of the controls, while 4.5 per cent. of the vaccinated population died, against 3.6 per cent. of the nonvaccinated. These are differences too small to

be significant. Tests made in other institutions gave similar results, though we need not take the time to consider the details here.

There are several other reports of the use of vaccines prepared somewhat along the lines of Dr. Rosenow's, but the data are not presented in a manner to permit of analysis.

The only report we have on a vaccine directed against the influenzal pneumonias associated with the fixed types of the pneumococcus is that of Cecil and Vaughan,[7] whose work was conducted at Camp Wheeler and was directed primarily against the usual pneumonias of the camp. Apparently the antipneumococcus vaccine reduced somewhat the incidence of influenzal pneumonia among the vaccinated, though, to use the author's words, "influenza causes a marked reduction in resistance to pneumonia even among vaccinated men." These authors show clearly that the case mortality of secondary pneumonias was not reduced by the vaccination, contrary to the claim so often made, that the vaccine, when it fails to protect perfectly, at least leads to a milder type of the disease. Cecil and Vaughan believe that the results of their experiment with respect to pneumococcus pneumonia were obscured by the influenza epidemic; evidence that the prophylactic action of the vaccine employed against influenza was not striking, since the epidemic should have served to emphasize rather than obscure the results of the beneficial action of a really valuable prophylactic agent.

We must next consider, briefly, the stock commercial vaccines made from about the same organisms that went into the vaccine prepared by Dr. Rosenow. Concerning these there are no accurate figures. So far as I have been able to determine, the preparations have not been used anywhere under properly controlled conditions. What we have to consider are, chiefly, the

7. Cecil and Vaughan: J. Exper. M. **29**: No. 5, pp. 457-483.

enthusiastic reports of observers whose faith was better developed than their judgment. A strenuous effort was made to secure the endorsement of the federal government for this form of prophylaxis against influenza. Under the direction of the Surgeon-General of the Public Health Service, careful investigators were sent to several communities from which glowing reports were received regarding the great value of stock vaccines, but in no case could the claims be verified. In this connection, we may trace the waning enthusiasm of one man who early in the epidemic reported that "immunization, using mixed vaccines, has proved beyond any question of doubt to be of great prophylactic value . . . why not extend this to all the people?" Ten days later, this man advised us that "we felt there was a strong possibility of it [the vaccine] preventing many cases. . . . At the present time we are not in a position to make any absolute and definite statement." So far as we know, the final reports from this source never have been published, though ample time has elapsed.

People wondered that those in positions of responsibility did not accept the first enthusiastic reports, adopt an attitude of optimism, and recommend the universal use of vaccination against influenza; but, in the light of present knowledge, there seems to have been some justification for an attitude of conservatism.

It must be clearly understood that what has been said above does not apply to vaccination against lobar pneumonia, using pneumococcus vaccine. The evidence on this is favorable, though perhaps the final word has not yet been said. It may be noted here that the very optimistic reports by Lister, who introduced vaccination against lobar pneumonia, are being called into question.[8] The rather startling suggestion is made by Fennel[9] that this antipneumococcus vaccine may be

8. Johnson: Am. Med. **25**: 149.
9. Fennel, E. A.: Prophylactic Inoculation Against Pneumonia, J. A. M. A. **71**: 2115 (Dec. 28) 1918.

useful in combating epidemic influenza, but he admits the "information at hand is fragmentary and not to be seriously considered though possibly significant."

Though the evidence in respect to any vaccine that has been tried offers little to warrant hope that an effective agent has been found, we must not feel unduly pessimistic. The problem of vaccination in influenza is an extraordinarily difficult one. The etiology is uncertain, the influenza bacillus and the streptococci are poor antigens, and the epidemics are so far apart and so rapid in passage that the time to work out a prophylactic agent is very limited.

CONCLUSION

The general impression gained from uncontrolled use of vaccines is that they are of value in the prevention of influenza; but, in every case in which vaccines have been tried under perfectly controlled conditions, they have failed to influence in a definite manner either the morbidity or the mortality.

VALUE OF CONVALESCENT BLOOD AND SERUM IN TREATMENT OF INFLUENZAL PNEUMONIA *

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The futility of the usual forms of treatment during the epidemic of influenzal pneumonia was early manifest. With a fatality much greater than our common pneumonia, it suggested the pandemics of old when "the pestilence stalked at noon day through the city, and the doomed inhabitants fell like grass beneath its scythe."

Though the causal agent was undetermined, it seemed that the serum of convalescents might possibly contain antibodies in sufficient quantities to influence favorably the course of the disease.

Serum from patients convalescent from scarlet fever was found by Huber and Blumenthal, Von Leyden[1] and others to be of some therapeutic value in that disease, and both experimentally and in human beings the serum of poliomyelitis convalescents is beneficial if used early.[2]

Richardson and Connor[3] recently demonstrated that the serum of patients convalescent from measles conferred a certain amount of immunity.

We did not know at this time that convalescent serum had been used at the naval hospital at Chelsea, Mass., and just as we were starting the treatment, McGuire and Redden[4] published their results.

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* From the Walter Reed General Hospital.

1. Kolmer, J. W.: A Practical Text-Book of Infection, Immunity and Specific Therapy, Philadelphia, W. B. Saunders Company, 1915.
2. Amoss and Chesney: J. Exper. M. **25**: 581 (April) 1917.
3. Richardson, D. L., and Connor, Hilary: Immunization Against Measles, J. A. M. A. **72**: 1046 (April 12) 1919.
4. McGuire, L. W., and Redden, W. R.: Treatment of Influenza Pneumonia by the Use of Convalescent Human Serum, J. A. M. A. **71**: 1311 (Oct. 19) 1918.

Our cases were too few in number to determine fully the value of this form of therapy, and the occurrence of a slight epidemic of hemolytic streptococcus cases early in 1919 increased the difficulty of interpreting our results. Yet certain observations were made that may be of interest and from them certain conclusions seem warranted.

Fifty-six patients received injections of convalescent serum, convalescent blood, or both. One other patient had several treatments, but is excluded because he had a large empyema when treatment was instituted.

Since we at first did not have enough serum for all cases, and as the mild ones usually resulted in recovery without any special treatment, we thought the best test would be to treat only those patients who were seriously ill. As will appear, some exceptions to this rule were made.

According to their condition when treatment was instituted, the cases were divided into four groups. This grouping is only approximately correct, as prognosis, at all times difficult, is especially so in an unfamiliar and very fatal malady.

Group A, 10 per cent. of the cases. Very favorable; mildly toxic; small area of pneumonia; no cyanosis nor vomiting; urine negative.

Group B, 19 per cent. Toxic symptoms more marked; pneumonia more extensive; mind clear; little or no cyanosis; seriously ill but recovery probable.

Group C, 30 per cent. Seriously ill; prognosis poor but patient not moribund, beginning gray cyanosis; often delirium; usually albumin and casts in the urine; as a rule, several lobes extensively involved.

Group D, 41 per cent. Very seriously ill; cyanosis, as a rule, marked; usually delirium or stupor; extensive lung involvement, with a rising temperature, pulse and respiration.

In primary pneumonia the respiratory rate in general gives a good index of the seriousness of the infection.

In influenzal pneumonia the patient may be very toxic and have a poor prognosis, but with respirations only slightly increased.

In a group of patients selected because of their serious condition, the mortality rate to be significant should be compared with a like number of equally sick untreated patients. So overwhelming was the epidemic that this could not be done. The mortality in 435 cases of pneumonia, including those patients treated with convalescent serum, was 52 per cent.[5] The mortality of the serum-treated patients was approximately 45 per cent, but the prognosis was distinctly bad in over 70 per cent. when treatment was instituted. Twelve of the fatal cases were in Group D, three in Group C, and in only one, a pregnant woman, did the prognosis seem fairly good. She aborted; the temperature reached normal, but death ensued (Case 8).

Of the favorable cases (Groups A and B) the mortality was less than 25 per cent.

In a few cases which ended in recovery following the use of convalescent blood or serum, it did not seem that the outcome was in any way influenced by the treatment. We accordingly have listed these as unimproved in the classification appearing below.

There was a difference of opinion among the medical officers at the hospital as to the merits of the treatment. Lieut. A. D. Rood,[6] in charge of the general pneumonia ward, considered it to be without value. Capt. Sothorne Key, the ward surgeon of the officers' ward, thought highly of it. Major Randolph, chief of the medical service, felt that in some cases it was of real value. As the medical officer who was directing this investigation, I appreciated the fact that the favorable results obtained in the officers' ward were not duplicated in the general ward. The reason for the difference, however, was not apparent until the two groups were studied separately.

5. Fell, E. W.: Postinfluenzal Psychoses, J. A. M. A. **72**: 1658 (June 7) 1919.
6. Rood, A. D.: New York M. J. **109**: 493 (March 22) 1919.

The accompanying table shows that in 80 per cent. of the patients in the general pneumonia ward the prognosis was poor at the time the serum was administered, and 60 per cent. seemed quite hopeless. In the officers' ward, on the other hand, the prognosis was unfavorable in 62 per cent. and utterly bad in only 22 per cent. The enlisted men had had their pneumonia 5.4 days when treatment was started, while the patients in the officers' ward had been ill only 3.9 days.

RESULTS OF TREATMENT IN TWO GROUPS OF CASES, AND THE DETERMINING FACTORS

	Number of Cases	Condition When Treated*: A Per Cent.	B Per Cent.	C Per Cent.	D Per Cent.	Day of Disease	Definite Improvement Per Cent.
Officers and Stat. Off.	32	16	22	40	22	3.9	72
Pvts. and N.C.O..	24	4	16	20	60	5.4	17

* A, B, C and D refer to the prognosis, A being very favorable, B, C and D increasingly bad.

Lamb and Brannin,[7] in studying the epidemic at Camp Cody, found that death occurred, on an average, at the end of 4.9 days after the onset of the pneumonia.

In the officers' ward, notwithstanding the fact that in 62 per cent. of the cases the prognosis was unfavorable, 72 per cent. of the patients showed definite improvement, while in the general ward only 17 per cent. were benefited.

All patients admitted to the wards for officers immediately came under the ward surgeon who was to have charge of them, and serum was frequently given within a few hours after admittance. All cases going to the general medical wards first went to the receiving ward where after a careful examination and short period of observation they were sent to their proper destination. This was deemed necessary to detect the contagious diseases and to avoid filling up the pneumonia ward with various other acute respiratory diseases. But a disadvantage existed in that the pneumonia patients

7. Lamb, F. H., and Brannin, E. B.: The Epidemic Respiratory Infection at Camp Cody, N. M., J. A. M. A. **72**: 1056 (April 12) 1919.

often did not arrive in the pneumonia ward till from twelve to twenty-six hours after admittance. When the cause of the difference in the results in the two wards became apparent, treatments were given in the receiving ward; but by this time the epidemic had nearly subsided.

It is noteworthy that all who have written on the treatment of influenzal pneumonia, irrespective of the agent used, state that good results are obtained only when treatment is given early; that is, within the first two or three days of the disease.

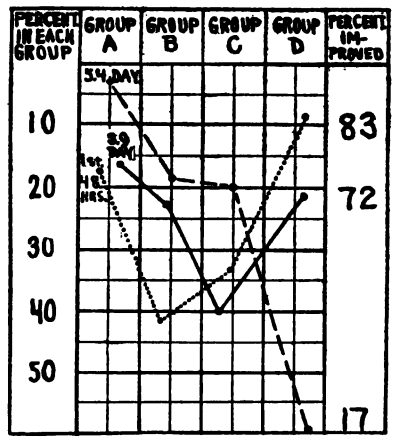

Chart 1.—Importance of early treatment: Groups A, B, C and D refer to the patient's condition when treated, A being most favorable, D least so. The first column shows the percentage in each group. Broken line, patients ill 5.4 days when treated; 60 per cent. in Group D, of whom 17 per cent. only improved. Solid line, patients ill 3.9 days; only 22 per cent. in Group D, while 72 per cent. were benefited by treatment. Dotted line, twelve patients ill not over two days; 8 per cent. were in Group D, and 83 per cent. showed definite improvement.

In twelve of our cases, treatment was given within forty-eight hours after the appearance of the pneumonia. One patient had a beginning empyema when treated. Of the eleven remaining, all except one (90 per cent.) recovered. The fatal case was a hemolytic streptococcus infection.

McGuire and Redden[8] had an exceptional opportunity to observe the effect of convalescent serum in a

8. McGuire, L. W., and Redden, W. R.: Treatment of Influenzal Pneumonia by the Use of Convalescent Human Serum, J. A. M. A. 72: 709 (March 8) 1919.

small but virulent epidemic of influenza that developed among the officers and crew of the *Yacona*. Twenty cases of bronchopneumonia developed in eighty patients with influenza. All were promptly treated with serum, and all except one recovered.

In the first cases treated we used the serum obtained after allowing the blood to clot. Later we adopted the suggestion of Hartman[9] and collected blood in sodium citrate solution. The serum thus obtained is plasma, but, for the sake of simplicity, is called by the more common name. Twenty-eight patients in 59 per cent. of whom the prognosis was unfavorable, received a total of forty-nine injections of serum, and in one half, definite improvement resulted. Five of this group who did not improve developed a hemolytic streptococcus infection. One died from a pneumococcus Type IV meningitis.

In ten cases, seventeen injections of citrated blood of pneumonia convalescents were given. Six patients received only one injection, three received two each, and one was given five. In eight of the ten patients the prognosis was poor, in two utterly hopeless. The two last mentioned died, but five of the other six who were seriously ill definitely improved. The only patient not seriously ill who did not improve developed an empyema.

In eighteen cases at least one injection of convalescent blood and one of convalescent serum were given. The fact that all required more than one treatment would indicate that they constituted a more unfavorable group than the other two. The prognosis was bad in 83 per cent., and only 39 per cent. showed improvement.

The number of injections required to obtain the desired result is of interest. The chance of recovery is inversely proportionate to the number of treatments

9. Hartman, F. W.: New Methods for Blood Transfusion and Serum Therapy, J. A. M. A. 71: 1658 (Nov. 16) 1918.

required. Of twenty-seven patients in whom marked improvement was noted, fourteen required only one treatment, five received two (the second injection was probably unnecessary in two cases), and five required three treatments. Only one patient received four treatments who was benefited, and two who received as many as five showed improvement. The last two had been ill a long time and received small amounts of serum. Had larger amounts been used, it is possible that fewer treatments would have been required.

McGuire and Redden[8] used only one injection in one third of their cases, and of the remainder, two thirds needed only two. We used from 100 to 150 c.c. of serum; from 300 to 400 c.c. of whole blood was usually used, though in a few of our earlier cases amounts of less than 100 c.c. were employed. One of our most striking cases was in this group (Case 1). When blood was used, donor and recipient were always typed for agglutinins. This is not necessary with serum. Pooled serum was used in about one half the cases. We obtained the blood when the temperature had been normal about ten days, depending on how seriously ill the patient had been. Officers, their wives and nurses, gave their blood as willingly as did the patients in the general ward.

EFFECT OF CONVALESCENT SERUM ON THE SYMPTOMS AND COURSE OF THE DISEASE

Conscious patients in whom the influenza symptoms were marked, experienced relief, almost without exception, in a few hours. Headache and malaise would cease and a number of times severe vomiting of several days' duration promptly stopped (Cases 2 and 20). The detoxication was quite a definite thing. I talked with many officers and nurses during convalescence, and with hardly an exception they said they "felt entirely different" after the treatment. Cyanosis when not extreme would show improvement within twenty-four hours (Cases 3 and 4). One intensely jaundiced

patient showed a remarkable clearing up of his jaundice within forty-eight hours after his treatment (Case 5).

The slight clouding of the sensorium frequently present was usually dissipated, but only occasionally did the patients who were delirious show a prompt clearing of consciousness. The rule was for the temperature, pulse and respiration to begin to fall, reaching normal in from thirty-six to forty-eight hours, depending on whether there was a chill. No change would be noted in the mental picture until from twenty-four to thirty-six hours later.

No improvement took place in the mental condition of one patient who had a complicating empyema and was much disoriented for weeks, though he received six treatments. He ultimately recovered. Ross and Hund,[10] using convalescent citrated blood, found that the temperature reached normal 1.5 days after the treatment and 9.5 days after the outset of the disease, while, with the untreated patients, the temperature did not become normal till the fifteenth day.

It was the rule that no extension of the pneumonic process took place after improvement in the symptoms occurred. A similar observation was made by McGuire and Redden. In a few cases, however, after a slight though definite improvement, a rapid extension followed with a fatal termination as a rule. One officer who showed such an extension into the only uninvolved lobe again showed prompt improvement and recovered when another treatment was given (Case 6).

Cowie and Beaven,[11] as a rule, found an increase in the signs following the use of typhoid vaccine.

The physical signs often would show no improvement until several days after the temperature, pulse and respiration had reached normal and all symptoms

10. Ross, C. W., and Hund, E. J.: Treatment of the Pneumonic Disturbances Complicating Influenza, J. A. M. A. **72**: 640 (March 1) 1919.

11. Cowie, D. M., and Beaven, P. W.: Nonspecific Protein Therapy in Influenzal Pneumonia, J. A. M. A. **72**: 1117 (April 19) 1919.

had subsided. In fact, the roentgenologist not infrequently would consider the patient still very critically ill, or even progressing, from a study of the daily negatives, when clinically he was quite convalescent.

After seeing the lungs at postmortem, it is difficult to understand how organs exhibiting so little normal tissue can continue to function, and it is even more remarkable that recovery sometimes takes place.

REACTIONS

Transfusions of normal citrated blood for various conditions are followed by a chill in about 20 per cent. of the cases.[12]

A reaction took place in twenty-three (16 per cent.) of our series of 140 intravenous injections. It is quite possible that a few patients may have had a slight reaction that escaped notice. The reaction was such as is seen following the injections of various foreign proteins. Within half an hour the patients feel chilly, and then have a shaking, followed by an elevation of temperature. In only one instance did the temperature go very high, and then 107 was recorded. As a rule, the temperature rapidly fell, reaching normal in about twelve hours.

Reactions occurred with about equal frequency with whole blood and with serum.

O'Malley and Hartman,[13] using plasma, report a "response," usually a chill and sweat, in 75 per cent. of their cases, and the improvement was more prompt when the reaction took place.

RESULTS OF REACTION

In the great majority of instances, coincident with the fall in the temperature following the chill, the pulse and respiration dropped and there was marked clinical improvement. This took place with such regularity

12. Lewisohn, R.: Am. J. M. Sc. **157**: 253 (Feb.) 1919. Pemberton: Surg., Gynec. & Obst. **28**: 262 (March) 1919.

13. O'Malley, J. J., and Hartman, F. W.: Treatment of Influenzal Pneumonia with Plasma of Convalescent Patients, J. A. M. A. **72**: 34 (Jan. 4) 1919.

that we considered a chill a good omen. But in the case of four patients, all very ill, the reaction may have hastened their death (Case 7). It seems possible that the severe reaction in Case 3, reported by Cowie and Beaven,[11] following an injection of typhoid antigen, may have hastened the fatal outcome, though they do not suggest this possibility. A severe reaction in a very sick patient is not to be regarded lightly. It may save his life, and it may hasten his death.

In the case of two of our patients who were treated at the same time, with serum a week old, marked flushing of the face accompanied the reaction (Cases 7 and 8). The serum was perfectly clear and sterile and free from any preservative. With this exception, the serum used was rarely over two days old. The blood was never over twenty-four hours old, and as a rule it was used within twelve hours. Blood not used when obtained was put into serum at the end of twenty-four hours, or sooner, if the donor and recipient were not compatible.

Prior to a few years ago, it was assumed that the reaction resulting from the injection of an antigen was a specific one. The improvement in chronic arthritis following the reaction induced by the intravenous injection of typhoid antigen demonstrated that bacteria in no way responsible for the pathologic condition could cause a reaction that might be followed by improvement. Yet these "nonspecific" reactions may be more specific than at first appears. It is, indeed, quite possible that they furnish the incentive for the production of specific antibodies.

Beneficial results have been reported in various conditions employing a variety of foreign protein.

Cowie and Beaven[11] were able to produce a reaction in influenzal pneumonia which in several instances was followed by improvement by injecting typhoid antigen.

Lamb and Brannin[7] observed improvement following the injecting of a variety of foreign protein, but only when a chill was produced.

Roberts and Cary[14] employed a vaccine made of pneumococci, Types I, II and III, streptococci and staphylococci; and when a reaction was produced, improvement usually followed.

It is noteworthy that in 80 per cent. of our cases in which definite improvement was shown, there was no reaction which is suggestive of specificity.

Nineteen patients received injections of blood or serum from healthy individuals who had not had influenza or pneumonia. One having an empyema when treated is not considered. In five the prognosis was good (A and B), and 20 per cent. seemed benefited. This is in striking contrast to the 75 per cent. showing improvement in the same type of cases with convalescent blood or serum. In fourteen the prognosis was poor, and in 21 per cent. of these improvement followed. In one very sick patient the result was striking (Case 9). It is therefore evident that except in an occasional case the transfusion of "normal" blood is without benefit, with which opinion McGuire and Redden[8] concur.

Ten patients received serum or blood from patients who had had influenza but not pneumonia. Leaving out of account one patient with a large empyema, there were nine to be reported on. The prognosis was poor in six. Slight improvement followed in one case, and in two others, in both of which a chill occurred, there was marked improvement (Case 11). In all, twenty injections of blood or serum of influenza convalescents were given, and in four (20 per cent.) a reaction occurred.

On the assumption that the pneumonia following influenza might be due to secondary organisms, possibly the pneumococcus, we decided to try the effect of transfusion from healthy adults who had not had influenza or pneumonia, and who had been vaccinated

14. Roberts, Dudley, and Cary, E. G.: Bacterial Protein Injections in Influenzal Pneumonia, J. A. M. A. 72: 922 (March 29) 1919.

with the triple vaccine prepared at the Army Medical School.

Notwithstanding the fact that almost all of our pneumonia cases belonged to Type IV, we thought this worthy of trial because Cecil and Austin[15] found that vaccination against the first three types appeared to diminish the number of Type IV infections. Blood was obtained a week following vaccination, as, at that time, immune bodies are at their maximum.

In seven cases the "normal" immunized blood or serum was given, but in only one case did improvement follow (Case 12). This was a lobar pneumonia with a high leukocyte count, and as the serum was administered on the fifth day, it is possible that the falling temperature was the normal crisis. In this connection it is of interest that Cecil and Vaughan[16] found that prophylactic vaccination with the pneumococcus lipovaccine did not lower the mortality in influenzal pneumonia.

Two patients with a hemolytic streptococcus pneumonia were given transfusion from patients convalescent from hemolytic streptococcus tonsillitis. One showed no improvement; the other had two injections, both being followed by a chill, and recovery took place (Case 13).

STUDY OF THE LEUKOCYTE COUNT

Uncomplicated cases showed the leukopenia so characteristic of the disease. A steadily rising count usually heralded the advent of an empyema. It did not seem that the degree of leukopenia afforded any trustworthy guide as to the prognosis, though a very low count indicates a general infection.

Notwithstanding that many counts were made, our records are not sufficiently complete to be of much value. It so happened that nearly all of the cases in

15. Cecil, R. L., and Austin, J. H.: J. Exper. M. **28**: 19 (July) 1918.
16. Cecil, R. L., and Vaughan, H. F.: J. Exper. M. **29**: 457 (May) 1919.

which complete studies were made before and after injections proved to be hemolytic streptococcus cases.

Ross and Hund[10] found that there was a rise in the leukocytes following the transfusion of convalescent citrated blood, which in some cases reached 24,000. A fall to normal was observed as further improvement took place. They do not state whether any difference was observed in the patients who reacted with a chill and in those without a reaction. An increase is commonly found following a protein reaction. In one of our cases the leukocytes rose from 3,300 to 23,000 following a sharp chill occasioned by the transfusion of convalescent blood.

In another case in which there was no reaction following the injection of 300 c.c. of convalescent blood, the leukocytes rose from 5,700 to 13,400 by the end of twenty-four hours. A patient who received 200 c.c. of "normal" serum without reaction or notable improvement showed the following count: before treatment, 5,100; first hour after, 5,100; second hour, 5,700; twenty-four hours later, 4,200.

An increase in the number of leukocytes was noted in some who died, while some showed a falling count. In others there was no change. Following three injections of convalescent serum given in one case during twenty-four hours without reaction but with well marked clinical improvement, the leukocytes rose from 3,000 to 11,300.

The intense congestion of the lungs that characterizes this malady affords an ideal site for the growth of various organisms, the most dreaded being the hemolytic streptococcus. The longer the patient is ill, the greater becomes the danger of the infection. It is perhaps significant that hemolytic streptococcus infections were more frequent among the patients treated with "normal" blood than among those receiving convalescent blood.

Of eleven cases in which convalescent blood or serum was given during the first forty-eight hours of

the pneumonia, in one a hemolytic streptococcus complication developed. Nineteen patients were treated on the third or fourth day, and eight died. Seven came to necropsy, and five showed the hemolytic streptococcus as the predominant organism. On the other hand, Lamb and Brannin[7] felt that the hemolytic streptococcus did not increase the mortality of influenzal pneumonia. We did not observe any difference in the results obtained with citrated blood, plasma or serum. Whole blood is to be preferred possibly on theoretical grounds, as the introduction of a considerable number of healthy blood corpuscles that will probably continue to function for some time might furnish material aid to the sorely taxed red cells of the recipient.

Cases of hemolytic streptococcus infections were fewest after the use of convalescent whole blood; but, as our series was small, too much significance should not be attached to it.

Specificity of action, which our cases suggest, is not borne out by the work of Lesné[17] and his co-workers, who have been investigating the action of citrated plasma. They believe that it acts as a foreign protein, and they found that patients injected with "normal" plasma or with their own plasma did as well as when convalescent plasma was used. Their series was small, and they appear to have produced a reaction in nearly all of their cases.

When laboratory facilities are at hand, the use of whole blood is simpler and quicker, as it takes only a few minutes to determine the iso-agglutinins. Plasma is obtained by allowing the citrated blood to stand several hours; no grouping of recipient and donor is required, and the serum from several donors can be pooled, which is of advantage.

It does not seem necessary at this time to describe the method of obtaining the blood and administering the treatment, as this has been taken up in detail by

17. Lesné: Presse Méd. **27**: 181 (April 7) 1919.

several writers on the subject.[18] To insure a supply of fresh serum, each patient when treated should promise to give some blood when convalescent.

SUMMARY

1. Fifty-six patients with influenzal pneumonia, in 70 per cent. of whom the prognosis was poor, were treated with the blood or serum of convalescent patients with a mortality of approximately 45 per cent.

2. Twelve cases were treated within forty-eight hours after the development of the pneumonia. One patient had a beginning empyema when treated; another developed a hemolytic streptococcus infection and died; and one other died. The remaining ten showed prompt improvement and recovered.

3. Thirty-two patients had been ill with pneumonia for an average of 3.9 days when treated, and 72 per cent. showed distinct improvement.

4. Of twenty-four patients ill 5.4 days when treated, 17 per cent. showed improvement.

5. Nine patients, six of whom were seriously ill, were treated with blood or serum of patients convalescent from influenza but who had not had pneumonia. Only two exhibited well marked improvement following the treatment, and both reacted with a chill.

6. Nineteen patients received transfusions of blood or serum from individuals who had not had influenza or pneumonia. No better results were obtained in the cases in which the prognosis was favorable than in the serious cases. Twenty per cent. seemingly were benefited.

7. Nine patients were given blood or serum from healthy adults vaccinated a week previously with triple pneumonia vaccine. In only one case, a lobar pneumonia with a leukocytosis, did improvement follow.

8. Sixteen per cent. of our patients treated with convalescent serum reacted with a chill and rise of tem-

18. Compare Footnotes 4, 7, 8 and 9.

perature. With but four exceptions prompt improvement followed the reaction. In four critically ill patients, death was possibly hastened by the reaction.

9. In 80 per cent. of the cases in which definite improvement was shown no reaction was manifest.

10. Over half of the patients showing improvement required only one injection to obtain the desired results.

CONCLUSIONS

1. The transfusion of "normal" blood or serum is only exceptionally of value in influenzal pneumonia.

2. The blood or serum from individuals vaccinated against pneumococcus Types I, II and III possesses no advantages over "normal" blood in this type of pneumonia.

3. Too few patients were treated with convalescent influenza serum to warrant definite conclusions. The impression received was that it was less potent than convalescent pneumonia serum but of more value than "normal" serum.

4. The transfusion of blood or serum from convalescent influenzal pneumonia patients is occasionally of value though used as late as the fifth day of the disease. When used early, within the first three days, a distinct improvement in all symptoms is to be noted in the majority of cases. It seems to lower the mortality, shorten the course of the disease, and diminish complications.

5. The early employment of convalescent serum, therefore, appears to be a therapeutic measure of definite value.

I am under deep obligations to Lieutenant-Colonel Nichols, director of the laboratory, and to his successor, Major Simmons, and to Captain Key, Lieutenant Rood and Lieutenant Stevens for their hearty cooperation, without which this investigation would not have been possible.

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TREATMENT OF INFLUENZA BY MEANS OTHER THAN VACCINES AND SERUMS

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This brief paper will be essentially an expression of personal opinion as to the treatment of influenza by means other than serums or vaccines. This opinion is based on an experience with the disease in the epidemic of 1889 and 1890 and the years immediately following, as well as in the epidemic through which we have just passed. Experiences of other physicians, as revealed by personal communication and by observation of their practice, are also laid under contribution. Many articles on the subject have been read, but no claim is made that the enormous mass of literature that has resulted from the visitations of this serious disease has been carefully studied or thoroughly digested. The task would be both discouraging and unprofitable, because so many of these articles are the result of superficial observation and limited experience; so many ignore the fact of the self-limitation of the infection and its natural course; so many conclusions are crude, and so many are reached by a mental process in which an optimistic credulity takes the place of the more desirable scientific skepticism.

Perhaps, however, the task would not be wholly unprofitable if it were to let us know more nearly where the profession stands today in the matter of drug and other treatment of influenza, and if it were to serve forcibly to bring home the lesson that as yet we have no specific treatment for the disease, no one

or two drugs on which all physicians are agreed as to their preeminent value in prophylactic or active therapy.

No drug is known to prevent the occurrence of influenza. Many have been tried, but a review of the reports made by optimistic clinicians is far from convincing. A drug of this category is quinin, warmly advocated, though without adequate proof, by many Italian physicians, but by others of the same country regarded as without value.

Segregation of those who are ill and the prohibiting of public gatherings must lessen the number of contact infections. Perhaps it would be more nearly correct to state that such measures lessen the rapidity of the spread of the disease by lessening the concentration of exposures. The impression one gets from a consideration of the incidence of influenza as it has occurred in the camps and larger cities is that in spite of all practicable quarantine measures the epidemic goes through the populace sparing the immunes, but affecting the susceptibles, approximately 30 per cent., of the total number. Prohibition of public gatherings seems to spread the disease more thinly over a longer space of time. It may act also to postpone the occurrence until such time as the less virulent type is prevalent. By this diluent action fewer fatalities may result. Both these are desirable ends, and so these measures are to be encouraged.

Reports of clinical observations and experiments vary as to the value of the gauze masks. There can be no doubt that a properly constructed mask worn by the patient must lessen the danger of droplet infection of nurses, attendants and other nearby patients, and thus minimize the danger of carriage of the disease or of crossed infections. The masking of physicians and nurses acts in the same way, though not to the same degree. The suggestive effect of the mask, emphasizing care as to cleanliness, is not to be undervalued.

The faulty way in which masks are sometimes constructed, the carelessness with which they are worn and the use of soiled masks are productive of no good and, at times, cause harm. The mask properly used has probably come to stay, though its exact value is far from determined. And such a clinical experiment as that in which the attempt was made to transfer influenza by the swabbing of the throats of healthy individuals with the nasal and throat secretions of influenza patients, without resulting transference of the disease, goes far to shake one's faith in the mask as a preventive measure against influenza.

In order to be convinced of the fact that there is no generally accepted plan of treatment, it is only necessary to see cases in consultation with other physicians, or to read the abundant literature on this disease of the last six months, or to go back to the voluminous writings published after the epidemic of 1890 and the years immediately following. The utter lack of uniformity as to drugs recommended is the best proof that there is no one remedy of sovereign value. That this is the fact, not alone in the English speaking medical world, but in other lands as well, is revealed by a perusal of the medical supplement of the *Review of the Foreign Press* issued by the British General Staff, War Office. Take, for instance, the number for April, 1919, in which there are abstracts from recent French, Italian, German, Scandinavian and Swiss journals. A catalogue of the remedies advocated reads: intravenous injection of camphor oil, camphorated oil with guaiacol, intravenous use of mercuric chlorid, intravenous injections of hexamethylenamin, quinin in large doses, collargol, colloid gold, colloidal metals in combination with antistreptococcal serum, calcium chlorid, neo-arsphenamin, diphtheria antitoxin and tetanus antitoxin. Certainly some one has blundered in reaching conclusions.

There is, however, one feature of the treatment of influenza on which all agree, namely, the importance of early rest in bed and the continuance of such rest until fever, cough and other symptoms have for several days disappeared. It is a common experience for the patient who does not at once give up when attacked by the disease, or who leaves his bed early and attempts to go to work the moment he thinks he has the requisite strength, to suffer from a recurrence of symptoms, possibly to have pneumonia appear, or to be incapacitated on account of persistent cough, irritable heart or nervous and muscular weakness. A few days added to the period of rest would often save the patient from a protracted convalescence or prevent serious sequelae.

A sunlit room, plenty of fresh air and a light diet with a liberal amount of liquids should be allowed and enjoined. The bowels should be opened fully at the beginning of the illness and not allowed to become sluggish at any time.

One of the hardest things to do in the treatment of a serious, self-limited, infectious disease is to refrain from prescribing drugs merely because the diagnosis has been made. The self-restraint of the level-headed physician is likely to be swept aside by the thought of the possible grave consequences of the malady, and his accustomed good judgment is apt to be smothered in the semihysterical atmosphere of alarm that pervades the community during the visitations of the epidemic. He forgets that a large proportion of patients with influenza do not need a single dose of medicine. There should be no routine treatment according to which certain drugs are given at stated periods, whether or not there is a clear indication for their use. The treatment is really expectant, symptomatic and individualistic.

It was my lot to be in charge of the influenza isolation wards in the Presbyterian Hospital, Chicago,

during the recent epidemic. There were about 160 nurses, members of the hospital personnel and medical students from Rush Medical College who were patients. The disease was vicious and severe; pneumonia and other serious manifestations were common. Of the 160 patients, only one died, a nurse. So far as I could learn, there had been no prophylactic vaccination or use of serum in any case; no treatment of this kind was instituted in the hospital. There were no standing orders as to drugs. No acetylsalicylic acid, phenacetin, digitalis, codein, quinin, atropin or other remedy was to be prescribed as a routine. Rest in bed from the very beginning of the symptoms, and for several days after the cessation of the symptoms, was the standing order. Liquids were given freely. I have wondered whether if I had used some vaccine or serum or other supposed specific I might not now be eager to get into print with my record of only 0.6 per cent. mortality. Nay, I should have been in print long before this. I merely have the satisfaction of knowing that no lives were taken by drugs (I think I am free of the charge in the one fatal case with extensive pneumonia), and that cautious conservatism gave Nature a chance to work a cure. We trust we helped her in her healing work.

The remedy that seemed of greatest value was digitalis. Without waiting for alarming indications of failing heart to develop in the way of feeble tones, rapid action, arrythmia or dilatation, digitalis was given by the mouth, hypodermically or intravenously in small or large doses as need arose. I am sure that by its intravenous use several patients were very materially benefited, and that in some instances dangerous or even fatal heart failure was averted. I never saw harm result from its careful use, except that occasionally it induced nausea when given in large or frequent doses, as it necessarily had to be. Next

to digitalis, the drug that seemed to me to be most helpful was opium—nearly always given as a hypodermic of morphin, or when the allaying of an annoying cough was the desired aim, in the form of heroin or codein. Pain, sleeplessness and severe cough have seemed clearly to indicate its use. The benefit from one sixth grain of morphin to the patient who, racked with cough and distressed by the pain of a pleurisy, has not slept for twenty-four hours, is too self-evident to need argument. There is too much fear of a hypodermic injection under these circumstances; fear both on the part of the physician and of the laity. Camphorated oil may be extremely helpful when there is a weak heart. In influenza in a patient who had been asthmatic and in whose chest there was much wheezing, I have seen good come from administering epinephrin. Hypodermoclysis or proctoclysis may be helpful. I think I saved one life by bleeding.

But I must be careful, or I shall lay myself open to the charge of having my pet drugs, or a treatment which I claim is curative. And to have favorite remedies which we talk about too much is to expose ourselves to the danger of believing in them more than is warranted by the facts. Even the quack comes to have a half-way belief in the curative powers of his methods. One ought not to be a nihilist as regards drugs in this disease; but no apology is needed for being a good deal of a skeptic as to the value of much of the therapy that is prevalent. Wholesale and indiscriminate drugging and the giving of huge doses is much too common. There should be a management of influenza as rational and simple as that of a developed case of typhoid fever, in which, today, in the hands of the intelligent physician and the enlightened public, drugs play a subordinate rôle. How much harm may be done by overdrugging no one can estimate. But the danger is real and not imaginary.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. ROSENAU, FROST, PARK, CONNER, ROSENOW AND STURDIVANT, MC COY, STOLL AND HERRICK

DR. AUGUSTUS B. WADSWORTH, Albany, N. Y.: The essential conditions under which the etiologic relationship of an organism to an infectious process is established have not been fulfilled with any organisms that have been isolated from influenza. We attempted to study this whole problem very carefully and thoroughly—bacteriologically and pathologically. At first we failed to find the influenza bacillus in the cases studied, but later, with improved technic, we were able to establish its presence. At first these cultures apparently were all similarly variable in morphology and uniform in their hemophylic cultural reactions. The thermal limits of growth were found to be quite constant and uniformly low, as compared with many other pathogenic species, ranging between 40 C. and 41 C., and nearly all of the cultures failed to grow above 40.5 C. By further study it was found that twenty-two cultures of influenza did not acidify any of the carbohydrates; forty cultures acidified dextrose; and sixteen other cultures formed both gas and acid in dextrose. The toxicity of these cultures varied greatly in animals. Infections seldom developed in them. When injected into the trachea of rabbits, the cultures of the influenza bacillus and their filtrates frequently gave rise to considerable lung reaction and lesions quite as extensive as those induced by pneumococci. In some instances, the lung lesion was more marked when both pneumococci and influenza bacilli were injected. Many of the lesions found in the rabbits' lungs after injection with pure cultures of the influenza bacillus resembled very closely lesions found in the lung at necropsy in cases of human influenza. But the most toxic reactions of purely hemorrhagic pneumonitis so characteristic of the lung involvement of human influenza were not marked in these experiments in rabbits. Twenty-four hours after tracheal inoculation, the influenza bacillus was recovered from the lung lesion, but at the end of forty-eight hours, no organism was obtained. Evidently the rabbit is relatively insusceptible to infection with the influenza bacillus. In our study of the practical value of the vaccine of the influenza bacillus, we made investigations in thirty-three state institutions. In twenty-eight we found that a greater number of cases of influenza developed among the vaccinated than the unvaccinated after vaccination had been started. In another institution the number of cases that developed among the vaccinated was 1.24 per cent. and 1.1 per cent. among the unvaccinated; and in another, among the vaccinated 2.48 per cent. and 4.2 per cent. among the unvaccinated. In another institution 461 inmates were vaccinated. Dr. Park's

laboratory failed to find the influenza bacillus in more than three inmates. The institution was very carefully quarantined during the epidemic, and no influenza developed for three months. Then there was an outbreak of 203 cases, 166 cases developing among the vaccinated inmates and thirty-seven among the unvaccinated inmates. The cases that occurred among the unvaccinated included those that were admitted to the institution after vaccination had been started. Of thirty-eight cases examined, thirty-two had influenza bacilli in the discharges.

DR. ANNA W. WILLIAMS, New York: I wish to emphasize one point in regard to the etiology of a pandemic disease, and that is, that there is no necessity whatever for wasting any time at first on determining whether an organism suspected of being the etiologic agent of the pandemic is pathogenic or not. The important thing is to decide whether or not we have one type among the strains isolated. Until this point is settled in the affirmative we need not pay any attention to the so-called postulates of Koch. If the pandemic is a true microbal pandemic, that is, starting from one cause and spreading through that cause, we should be able to prove that there is one variety or type of microorganism that is responsible for the pandemic. Of course, we have to determine what test we must choose to prove this. Up to the present, we have decided that we will accept the agglutination test with the absorption of agglutinins for the test of type until somebody proves that this test is not the final test. We have shown that all the influenza strains we have isolated do not respond to this test; that practically each strain is a law unto itself, with the exception of strains picked from one case. Now, if it is true that that test can be accepted, and if it is true that by our methods we have not missed a pandemic strain, or that the strains do not readily change in their power to produce the same agglutinins, then the influenza bacillus has nothing whatever to do with the initiating cause of the epidemic.

DR. EDWIN R. LE COUNT, Chicago: Certain salient facts stand out prominently in connection with this disease. One of the most astounding is the way in which it spread. It has been compared to measles and other similar eruptive fevers, and it may be that if the human race was as susceptible and less immunized to measles than it is, and we should have measles suddenly thrown on us, measles would spread over the world in a way similar to the spread of influenza, but outside of such a conception of measles, or some other infectious disease, we have nothing to compare influenza with, in the way in which it has extended. Therefore, it does seem that its causation should be in a way quite unique also. The clinical manifestations are correspondingly fairly clear, and through the investigation of MacCallum, Goodpasteur and Wolbach we are gradually getting

somewhat of a clear idea as to the changes peculiar to the disease. Among the changes that do occur, there are certain features of the lung alterations that are conspicuous. One has been noticed by all who have studied these conditions in dead bodies, and that is the exceedingly great wetness of the lungs, and the way in which the fluid of the blood runs out into the pleural cavities. In the earlier part of the treatment, a mistake probably was made in withdrawing such fluids from the pleural cavities, as it amounted to continued bleeding at intervals, which probably did harm. Later, I have understood, this treatment was somewhat abandoned.

Microscopically there are also a few features that are characteristic. One is the thin layer of fibrin in the minutest air passages. Such a limitation of fibrin to the lining of the air sacs is also rather unique in the histology of lung inflammations. About twelve or fifteen years ago an epidemic of what we called ordinary lobar pneumonia or lung fever spread over this country. Many thousands died in a few months. Since the epidemic of influenza last fall, we saw practically none of that old type of lobar pneumonia. Lobar pneumonia in an anatomic sense was observed during this epidemic of influenza; but not lobar pneumonia in the full clinical sense. The lobar pneumonia we saw is post-influenzal and is due to secondary infection; moreover, the lobar pneumonia observed during the recent epidemic has been unlike that of twelve or fifteen years ago and of even more recent years, different anatomically in at least one noteworthy way: the absence of a heavy "shaggy" precipitate of fibrin in the pleural cavity.

DR. HENRY ALBERT, Iowa City, Iowa: Dr. Frost stated, I believe, that we have no evidence of immunity against influenza. I should like to cite an instance in which I believe we have very good clinical evidence of the existence of such immunity. A state institution at Mitchellville, Iowa, was investigated by our epidemiologist, Dr. Hamilton. This institution had a population of 180. The inmates were housed in six different cottages, but all received instruction in the same room. Early in October, 1918, in connection with the general epidemic, the disease gained a foothold in this institution. The administrative officials immediately isolated all the affected persons. Inmates of only three of the cottages were exposed, and the disease was entirely limited to the inmates of these three cottages. Seventy-six cases occurred at this time. As a result of very careful isolation, no further evidence of the disease appeared until two months later. At that time, one of the teachers was given permission to leave the institution for a few days. She returned with the beginning of an attack of influenza. In the course of a few days another epidemic appeared, to which every person in the institution was exposed. During the second epidemic, there were eighty-two cases of the dis-

ease, but not a single instance of a recurrence of the disease among the seventy-six who had had the disease during the previous epidemic. Of the total population there were only twenty-two, or 12 per cent., who did not contract the disease during either of the epidemics. It seems to me very significant that during these two epidemics, out of a population of 180 persons, there was not a single case of recurrence during the second epidemic and I cannot help but think that it must be due to the development of immunity.

DR. ALEXANDER LAMBERT, New York: I was interested as I heard the other speakers refer to the difference in the clinical character of the pneumonias as modified by the recent epidemic. Perhaps, the experience with the pneumonias before the epidemic of 1889, during 1889, and during subsequent years, and in this epidemic may be of some interest. When I was in the hospital in 1885, 1886, 1887 and 1888, the pneumonias were clear-cut lobar pneumonias, very few of them bronchopneumonias. In 1889, as the influenza epidemic came to New York City, there were the same unusual pneumonias as in this last epidemic, with the same sodden kind of lungs. The pathology was clearly stated and taught by Delafield afterward, that the lungs showed a maximum of congestion and a minimum of exudation, and he further pointed out at that time that these were bronchopneumonias, but they did not differentiate the bacterial flora. They believed then that the pneumococcus caused them all and the streptococcus was not differentiated. Nor was it until 1892 that the description of the influenza bacillus was brought out. In 1892, within a few days after Pfeiffer's article was published in New York, I separated out the influenza bacilli for Delafield from some of his patients. The pneumonias for four or five years remained in New York, queer and patchy as if they were mild dying out types of influenza. They later became more the pure lobar type, and that continued through quite a while. Later, in 1901, an epidemic of grip appeared, and the bronchopneumonia came back, and the lobar type seemed to disappear again. Five or six or seven years ago the type returned to the clear-cut lobar type, and again it has returned to its predominating bronchopneumonia type. The differentiation this time which is helping to solve the problem much more clearly and intelligently is the differentiation of the primary and the secondary infections, the differentiation more clearly of the influence of the various bacteria, and particularly of the serious influence of the streptococcus. In studying the various types with the roentgen rays the pathology was clear and easy to understand.

DR. FRANK W. HARTMAN, U. S. Navy: I want to confine my remarks to the treatment with convalescent serum, except to verify Dr. Herrick's remarks with regard to the prophylaxis and early observation of the cases. At the Naval Academy there were during the epidemic about 1,400 men.

These were kept under closest supervision and put to bed with the first signs of illness. Although the number of cases was large there was an extremely low incidence of pneumonia and only four or five deaths. In Washington many patients came in with advanced pneumonia. Dr. Stowell has done a great deal to put the treatment of influenzal pneumonia with the blood serum or plasma from convalescent patients on a better basis. He has had the courage to run two series of controls, using normal serum in one and the serum of vaccinated persons in the other. The results from these cases were practically negative. In Boston ten patients were selected, five were treated with normal serum and five with convalescent serum. The following day the five treated with normal serum had a temperature as high or higher as that at the time of treatment. The five treated with convalescent serum all had normal temperature. At first, believing that the plasma must be compatible with the blood of the patient, we were unable to treat all our cases. There were four such untreated cases with two deaths resulting. Among eleven treated cases admitted during the same period, one death resulted. There are several reports of treatment with nonspecific proteins, notably those of Roberts and Cary and Cowie and Bevan. Naturally, the question arises as to whether the action of convalescent serum is not nonspecific. I believe that we can answer this question in the negative inasmuch as we find that the nonspecific treatment depends entirely on the severity of the reaction produced and is only effective in the initial stage of the disease. On the other hand, results with convalescent serum may be as good or better when no reaction or only profuse perspiration follows administration as when severe chills and high temperature result. Indeed, every precaution would be taken against severe reactions in elderly persons and children. This is best accomplished by using centrifuged plasma or by administering serum and plasma intramuscularly. The method of choice depends largely on the facilities at hand. In using whole blood, compatibility tests require a great deal of time and utmost care. It is also impossible to match every patient with a convalescent. Again, we are unable to pool the blood from a number of convalescents. The red cells injected, as far as we know, do not carry antibodies, but they may paralyze the blood forming organs if injected in sufficient amount. Whole blood does apparently produce a distinct leukocytosis which is not seen after the use of serum or plasma. Blood serum is, perhaps, most easily obtained and handled. It is, however, more toxic and contains none of the formed elements of the blood. As we have shown, blood plasma is attainable without special apparatus and has the advantage of containing the white cells of the blood. All workers agree that streptococcus pneumonia or empyema, developing early in the course of the disease, will prevent response to any

form of treatment. In four cases we were able to say that the patients had empyema because they did not respond in the usual way to the injection of convalescent plasma. Clinical signs of empyema in these cases were not definite but empyema was demonstrated with the needle.

We have been able to collect more than 400 cases of influenzal pneumonia treated with whole blood, serum or plasma of convalescent patients by ten different observers, all of whom believe and demonstrated the treatment to be of definite value. Failures in several instances which I have observed personally have been due to the hospital system and delayed treatment. In other instances the treatment was pronounced a failure in the first wave and was a success in the second wave. We believe that this method is second only to prophylaxis in combating influenzal pneumonia, and that it should be used until we discover the etiologic factor and are able to produce a more effective serum in larger quantities by immunizing animals.

DR. H. B. WOOD, Providence, R. I.: One important factor was the hemolytic infection of the throat in army camps throughout a number of states during the summer of 1917. A house-to-house canvass in five towns in New York state showed that about 85 per cent. of the persons closely exposed to the infection contracted the disease. In other words, what we call influenza has about the same infectiousness as measles. Sex had absolutely no effect. The people contracted the disease according to their opportunity to exposure.

DR. SOLOMON SOLIS COHEN, Philadelphia: One may agree thoroughly with Dr. Herrick's philosophic principles, yet differ with his application of them. That different remedies are advocated for one malady by no means implies that all are worthless. All may be helpful under given conditions, or even if two are useless, the third may be good. The point is, that in a matter not susceptible of experimental proof, but depending on individual observation and therefore virtually a matching of opinion against opinion, we cannot condemn, offhand. It is true that there is among the younger teachers today no general agreement on the proper method of treatment, other than serums and vaccines; but in the epidemic of thirty years ago there came to be general agreement as to what was useful, what was useless and what was harmful. Antipyrin and acetanilid were at first advocated by great authority, but their deadliness was soon recognized. Unfortunately, in Philadelphia at least, that lesson was forgotten. If I may judge from what I frequently heard in the consultation room, there was a widespread tendency to use two very harmful drugs, acetylsalicylic acid and acetphenetidin. The peak of mortality in Philadelphia shown on the charts resulted from many factors, among others, the great industrial population drawn from all

over the country, the crowding and promiscuous visiting in certain quarters, the lack of doctors and nurses. But it may have been, in part, owing to this bad practice. Not that every one died who received these drugs; quite a number survived both the disease and the medicine; some, no doubt, to suffer later from weakened heart and nerve depression. But in the majority of the cases in which they were used, these drugs deprived the patient of his chance to recover. Of that, I have no doubt. Salicin and certain of its derivatives, namely, sodium salicylate and quinin salicylate and cinchonidin salicylate (not aspirin, the acetylsalicylic ester, remember—that is a dangerous cardiovascular depressant) were very useful, not as specifics, but as aids. Quinin dihydrobromid and quinin and urea hydrochlorid were also helpful, not only in cases which developed pneumonia, but in preventing pneumonia. DaCosta used to tell us that influenza is "at once the least fatal and the most fatal of all diseases." Of itself, the least fatal; in its complications and sequelas, the most fatal. If one thing has been brought out above any other in this discussion, it is that influenza is not merely a mixed infection, the term is not sufficient. Nor are the death dealing organisms merely secondary invaders. Influenza is a malignant symbiosis and must be studied from that viewpoint before we can understand its pathology and epidemiology. There is one drug that antagonizes the influenza poison, opposing this vital depressant throughout its whole range of influence. It is itself a dangerous drug if used indiscriminately; but it is helpful if used properly. That drug is coca, and its alkaloid, cocain, used with due caution and under proper indication.

Dr. Hyman I. Goldstein, Camden, N. J.: It is very fortunate for Dr. Herrick to have had the more or less unusual opportunity to treat most of his 160 patients from the very beginning and in a hospital. I would like to ask Dr. Herrick what he would do under the usual circumstances with which general practitioners are confronted. In attempting to prevent the numerous deaths which Dr. E. C. Rosenow told us resulted from the secondary complications, are we justified in using the vaccine? I think we are justified in using vaccine, even if we do not know the specific cause of influenza, as a preventive and therapeutic measure against the complications. We have not a "cure all" or "sure cure" for all cases of any one disease. But are we justified in doing away with the use of mercury and arsphenamin in syphilis because it is not a cure in all cases? Digitan (digipuratum), quinin dihydrochlorid, caffein and coden were used symptomatically with considerable benefit to my patients. Benzyl benzoate relieves the pertussis-like cough so often heard in this epidemic. We must make the best use possible of what we have and, of course, we hope that our experts will eventually give us something definite with which to work.

DR. FREDERICK T. LORD, Boston: There seems to me no ground for the belief that a vaccine in the treatment of disease is of any value whatever. Vaccines may be of use in prophylaxis, but they have never been shown to be of value in treatment. Regarding the use of convalescent serum in the treatment of influenzal pneumonia, the presence of protective substances in the blood at the time of or after the crisis in lobar pneumonia has been established, but they are not constantly demonstrable. In ordinary lobar pneumonia, therefore, treatment with convalescent serum can hardly be expected to be followed by any very striking results. Stress has been laid on the favorable symptoms resulting from the use of convalescent serum. In a disease so variable in its symptoms as influenzal pneumonia one may readily fall into error in a judgment based on favorable symptoms following the administration of serum. Only a judgment based on mortality should count, and also that one must take into account in that judgment the very variable mortality existing during the epidemic. In one of our camps the figures indicate that the mortality from influenzal pneumonia was at one time 54 per cent. In the Students Army Training Corps at Cambridge the mortality was 8 per cent. Among sixty-one cases in the civilian community the mortality was as low as 3.2 per cent. the figures being gathered from civilian physicians. In view of this variability in mortality, it would be highly undesirable to base any final judgment regarding the value of the method on any other than series of serum treated cases controlled by a simultaneous series not so treated. At the Massachusetts General Hospital we had twenty-three patients who were treated with convalescent serum, and of this number we lost six. At the same time we had twenty-five controls and we lost three.

DR. ALBERT E. ROUSSEL, Philadelphia: Experience in the 1889 epidemic and the present one, from the similarity of the clinical symptoms, would lead one to appreciate the fact that we were dealing with the same disease and probably due to the same organism. The second point of appreciation in both of these experiences is the fact that uncomplicated influenza has practically no mortality. It is true that the number of cases of complications of the respiratory tract were numerous in this present pandemic, and disproportionate to the first, but uncomplicated influenza practically cures itself, and there is no question at all that the existence of large bodies of troops in and around cantonments invited probably the same combination of organisms and, on the other hand, the diminished resistance of the civil population caused by underfeeding and worry made this probably the most intense and virulent type of influenza that we have yet seen and, possibly, that we may ever see. The proportion of jaundice was rather larger than has been mentioned. Possibly 4 per cent. of the cases of pneumonia showed

jaundice, and almost all the patients exhibited tenderness in the neighborhood of the gallbladder, and it is a question whether there were not many cases of catarrhal cholecystitis, and a number of other cases of a more severe type. Among 186 hospital cases of pneumonia, excluding the deaths that occurred within twenty-four hours, the mortality was a fraction of more than 25 per cent. On the other hand, I had at one hospital thirty-five cases of influenza among the interns and nurses with six cases of pneumonia, and all got well, because they were taken care of at the proper time. As regards drugs, I think bicarbonate of soda, in addition to the physiologic sodium chlorid solution, is of very considerable value. In the pneumonia cases, about 8 per cent. showed albumin urea, and about 4 per cent. distinct nephritis.

Dr. Will Walter, Chicago: My interest in this subject is from the viewpoint of prophylactic inoculation in its relation to the upper respiratory tract. I can enlighten Dr. McCoy as to the bacillus "septus," as I did a research about fifteen years ago after a visit to Wright's clinic and laboratory, where we studied *Bacillus septus,* which had been presented as a cause of acute rhinitis by Dr. Allen of London. I reported on 100 of 300 cases and analyzed the results. My research covered the bacterial flora of the upper respiratory tract and *Bacillus septus* was found in slightly more than 55 per cent. of my cases of acute rhinitis. Since that time I have not seen it, but it is still reported in English literature. It belongs to the diphtheroids. I took the liberty of changing the name of this bacillus to *Bacillus segmentosus.* It is a wedge shaped segmented organism tending to palisade formation. It is mentioned in the last edition of Jordan's textbook on bacteriology. Dr. McCoy's records, so far as they relate to preventive inoculation, show a violation of the fundamental principles laid down by Wright, who always was very emphatic and still insists on the postulate that if you are going to do preventive inoculation in the presence of an epidemic you must use very small doses—infinitesimal doses. In the cases I have seen reported by Dr. McCoy as failing to show results, enormous doses were given, and not only that, but they were repeated on the third and again on the fifth day. This would be the very method to bring about a negative phase and therefore to increase the susceptibility of the patients to the organisms against which we are inoculating. It must not be forgotten that this is done not to prevent influenza, the cause of which is unknown, but to immunize, as Dr. Rosenow says, against the known organisms which kill.

Dr. M. K. Wylder, Albuquerque, N. M.: Observations are very misleading. I use the prophylactic vaccine. I used it in a girls' boarding school in which I immunized, or at least attempted to immunize, the pupils, teachers, etc., and

at the same time we established and enforced a complete quarantine. There were eighty people in that institution; not a single case of influenza developed. One mother insisted on being admitted to visit her daughter. Being refused, she took the girl home. In less than a week that girl was dead from influenza.

DR. WILLIAM C. WOODWARD, Boston: Reference has been made to the influence of the closing of places of public assemblage and of the wearing of masks. I think, however, we may adopt a more nearly universal preventive measure that will tend to prevent not only influenza but also pneumonia, whooping cough, measles, diphtheria and diseases of the respiratory tract generally. We must learn to look on the discharges from the nose and throat as essentially as dangerous as the discharges from the urinary tract and the digestive tract. We must take the same precautions to prevent the transfer of such discharges from person to person that we take to prevent the transfer of fecal matter and urine, not merely when persons are sick, but continually, if we are going to control or do away with diseases of the respiratory tract. We must seek not only to control these mucous discharges in public places, but also in private life, at home, in places of employment, and so on. In short, we must at all times and all places take the same precaution to prevent the interchange of mucus and other secretions from the nose and the throat that we take to prevent the interchange of urine and fecal matter.

DR. C. C. BROWNING, Los Angeles: There is an element which I have not heard mentioned here that possibly may enter into some of the discrepancies which apparently characterize the statistical data in connection with this disease, the difference in the virulence of infection, or the acquired resistance of individuals of different communities. At Fort McArthur, during the earlier period of the epidemic on the Pacific coast, we received sporadic cases of influenza, about twenty-four cases from October 20 to 26, all of which came from the more or less thickly populated districts. These were of moderate severity; two cases of bronchopneumonia developed with no deaths. October 27 we received about 800 men who came from the mountainous districts and from the ranges in the West, men who were accustomed to outdoor life and had not been in crowded communities. Of these men forty were suffering with acute influenza. Within the next three days about 115 had been received into the hospital. Of these eight died within twenty-four hours of the first manifestation of symptoms; eleven died within forty-eight hours and twenty-eight died later. We learned from friends who visited the sick that the death rate was not larger among these recruits than among the families at home. Was the infection increased in virulence by reason

of the persons having been accustomed to contact with the more common infectious organisms?

DR. H. H. KOONS, Los Angeles: The epidemic reached us at the base hospital at Fort Sam Houston about October first. We used all the remedies recommended without avail. Then I began using the vaccines, very carefully at first, because vaccine therapy was not recognized as a treatment by the profession generally. In certain wards we got very good results. Almost uniformly within thirty to thirty-six hours after an injection of vaccine sufficient to get an initial rise of temperature, there was a very marked decline, better respiration, lessening of cyanosis and, in most cases, an improvement in the general condition of the patient. I did not suggest it as a specific but as an adjunct. We protected our patients from draughts and we put them to bed. We gave them fresh air, but not at the temperature of outdoor air. In the wards where I used vaccine the mortality rate in pneumonia was under 7 per cent. In the wards where we did not use vaccine but used all known precautionary measures, the mortality was 18 per cent. Approximately 100 patients were treated with vaccine. A great many more than that were not treated with vaccine.

DR. W. A. BASTEDO, New York: There is no evidence whatever that more acetylsalicylic acid and acetphenetidin was employed in Philadelphia than in New York or Boston or any other city; nor was our death rate any different, except that it was worse. A large number of patients who recovered had had very large doses of these drugs; others died, as did some who had had small doses.

DR. E. C. ROSENOW, Rochester, Minn.: The vaccine which we used was made to contain as soon after isolation as possible the bacteria isolated in influenza and the accompanying pneumonia together with type pneumococci. It contained, as we found months later, a high percentage of strains of green producing streptococci which, according to their serologic reactions, appear to bear etiologic relation to this disease and with which the picture of influenza has been closely simulated in animals. The lowered death rate and even the diminished incidence of recognizable influenza and the milder attacks noted in persons inoculated over that in the uninoculated, wherever the vaccine was properly used, is thus to be expected. A degree of protection from the use of this vaccine is just as rational, in the light of the newly discovered facts, as is the protection following prophylactic vaccination with pneumococci and other vaccines. The difficulties in evaluating the results, as pointed out by Dr. McCoy, have been considered and the sources of error eliminated. The immunity appears to be of relatively short duration, there being a falling off in six week to two months. The results recorded, however, represent observation extending

over a period of from three to six months. Revaccination, consisting of one injection of the middle dose every six weeks to two months, while the disease is prevalent or as new waves appear, is therefore to be recommended. Averaging all the results obtained, it appears that the incidence of influenza was about three times as common and the death rate five times as high among the uninoculated as among the vaccinated persons.

DR. JAMES B. HERRICK, Chicago: Dr. Goldstein asked a question as to what is a general practitioner, deprived of the opportunity to put his patients into a well-managed hospital, to do. I think that what he should try to do is to get hold of his patients as early as possible, insist on the patients going to bed, make them stay there until well and not to overdrug them. I have been very much impressed by the harmfulness of many plans of treatment. That is why I have not used the vaccine or serums. I am not on principle opposed to them, but I do not think that as yet we have the proof that they are helpful. They may even be harmful. And so I say that the general practitioner should, if possible, get his patient early and give him some general line of treatment that has at least the virtue of harmlessness. The patients that came into that same hospital from the outside, into the same ward, under the care of the same doctors, with the same nurses, the same hospital assistants, the patients that came in on the second, third and fourth days of the disease, often with pneumonia, died, with a mortality which was so large that I hesitate to confess it. If those patients had been got hold of earlier, in my opinion, more of them would have recovered.

LETHARGIC ENCEPHALITIS *

JOSEPHINE B. NEAL, M.D.
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For the past nine years we have had at the research laboratory of the health department of New York City a meningitis division, the function of the members of which is to see in consultation all kinds of meningeal conditions for differential diagnosis and treatment. In this connection we have seen over 1,000 cases of meningitis of various kinds, 600 or more cases of poliomyelitis and over 700 cases of meningism with various diseases, besides small numbers of cases of numerous other conditions, so that we have had a fairly good background for the study of a new type of meningeal or cerebral disease.

Last October, as a member of the research laboratory of the health department of New York City, I began to see a new type of disease. The majority of these patients gave a history of influenza followed in a varying length of time by headache, drowsiness and apathy, usually accompanied by a low irregular fever, strongly suggesting a slowly developing tuberculous meningitis. One of the earliest patients, "X," showed extreme restlessness instead of drowsiness, marked muscular weakness and some paralysis of the cranial nerves. These conditions suggested a variety of diagnoses. Meningism seemed possible in certain instances, perhaps caused by some gastro-intestinal disorder, or it may have followed, instead of accompanied, influenza; this, however, was ruled out as the spinal fluid showed a marked increase in the protein elements and cells instead of being normal, as is the rule in meningism. Syphilitic disease was suspected, especially in "X," but this was disproved by the negative Wassermann test and by the character of the gold chlorid curve. Brain tumor must be differentiated in certain of the more severe cases, and this differentiation has proved a stumbling block to some very eminent neurologists. Tuberculous

* From the Research Laboratory Department of Health, New York City.

meningitis was considered in many cases, but this diagnosis was discarded because of failure to find the tubercle bacilli either by smear or by animal inoculation, the normal reduction of Fehling's solution and the favorable termination. In some instances the encephalitic type of poliomyelitis was suggested by the clinical picture and by the spinal fluid findings, but this type is rare even in epidemics of poliomyelitis, and during the fall and winter the number of cases of even the spinal type has been extremely small. Finally, I began calling these cases influenzal encephalitis, since the symptoms were those of encephalitis and since they so often followed influenza. Not until midwinter did I designate these cases lethargic encephalitis, as it was not until that time that I encountered patients with lethargy, asthenia and oculomotor palsies, the characteristic triad of symptoms described by the English and French. Table 1 gives some of the salient features of forty cases in which the diagnosis seems to be well established. A study of the table shows: (1) wide age distribution—from twelve weeks to over fifty years. From the nature of our work we see an unusually high proportion of children. (2) The large proportion of males, thirty-three out of forty. Tucker reports nine males out of eleven cases. In other reports, usually of smaller numbers, there has not been this marked difference. (3) The history of an attack, clinically influenza, in twenty-seven of the forty cases. It will be noted that the onset is more often slow than sudden, and that lethargy and asthenia are nearly constant symptoms, while cranial nerve or other palsies are present in less than half of the cases. It is possible that our list includes a rather high proportion of mild cases, since we are called in consultation where an early tuberculous meningitis is suspected. Where lumbar puncture is not so freely resorted to, I fancy that many of these milder cases are unrecognized.

REPORT OF CASES

Certain patients are perhaps of sufficient interest to deserve special attention.

CASE 1.—Patient 357 had a typical mild case. He had influenza early in October. About the middle of October he became gradually worse, with headache, vomiting, constipation (which the French call the meningitic triad), irregular fever (102 to 104 F.), and marked apathy. This history was very suggestive of tuberculous meningitis. I saw him October 27. He was then somewhat improved. His mental condition was nearly normal, there was no

TABLE 1.—SALIENT FEATURES OF FORTY CASES OF LETHARGIC ENCEPHALITIS

Case No.	Age	History of Influenza	Type of Onset	Lethargy	Asthenia	Headache	Palsies	Reflexes	Temperature	Vomiting	Miscellaneous	Duration	Outcome	Remarks
14	12 wk. M.	+	Slow	Slight	Slight	.....	—	—	100	+	.....	?	Recovered	
388	8 mo. M.	+	Slow	+	.....	.....	.....	—	102	—	Slight convulsions.....	7 days	Died	
368	9 mo. F.	—	Sudden	—	.....	.....	Int. strabis.	—	To 105	—	Irritability.....	2 weeks	Recovered	
32	15 mo. M.	+	Slow	++	++	.....	.....	—	Slight	+	Mask-like expression, spasticity, marked tremors, convulsions just before death, marked arrhythmia	3 weeks	Died	
5	15 mo. M.	+	Slow	+	+	.....	—	?	+	+	.....	4-5 weeks	Recovered	
9	18 mo. F.	+	Slow	+	+	.....	.....	N.	102-108	—	Tremors.....	1 week	Died	
371	20 mo. F.	+	Slow	+	.....	.....	Int. strabis. rt. facial	—	Slight	+	Convulsions.....	3 months	Died	
94	2 yrs. M.	+	Slow	++	++	.....	—	N.	101	+	.....	10 days	Recovered	
49	2 yrs. M.	+	Slow	+	?	.....	.....	—	104	+	Rotating of eyeballs, twisting of lips, difficult respiration, convulsions, arrhythmia	6 days	Died	
54	3 yrs. M.	+	Sudden	+	+	+	—	—	104	+	.....	4 weeks	Recovered	
16	3 yrs. M.	+	Slow	+	+++	.....	.....	—	Slight	—	Convulsions.....	3 weeks	Recovered	
87	3½ yrs. M.	—	Sudden	++	++	+	.....	—	100	+	.....	10 days	Recovered	
351	4 yrs. F.	Probable	Sudden	+	?	+	.....	—	Slight	+	Convulsions.....	Less than 1 month	Recovered	
137	4 yrs. M.	—	Sudden	+	?	+	.....	—	Slight	+	Conculsions.....	2 weeks	Recovered	
391	6½ yrs. F.	+	Slow	+	+	—	.....	N.	100.5	—	.....	2 weeks	Recovered	
395	7 yrs. F.	—	Slow	++	++	+	.....	+	101.5	—	Tremors.....	2-3 weeks	Recovered	
19	7 yrs. M.	+	?	++	++	+	.....	.....	104	—	.....	3 weeks	Died	
41	7 yrs. M.	+	Slow	++	++	+	.....	— left N. rt.	104	—	Spasticity of legs, vacant expression	4 weeks	Recovered	
80	9 yrs. M.	—	Sudden	+	+	+	.....	N.	Slight	—	Babinski.....	2 weeks	Recovering	
357	9 yrs. M.	+	Slow	++	++	+	.....	—	104	+	.....	1 month	Recovered	
46	9 yrs. M.	—	Slow	+++	+++	.....	Facial Slight dysphagia	++	+	—	Babinski, mask-like expression, tremors at times, arrhythmia	3 months	Improving	
35	10 yrs. M.	+	Sudden	++	++	+	.....	—	+	+	Convulsions.....	2 weeks	Recovering	
100	10 yrs. M.	+	Slow	++	++	+	.....	N.	Slight	+	Babinski, pupils unequal.....	7-8 days	Died	
38	11 yrs. M.	+	Slow	+	+	+	Rt. facial	D.	101	—	Delirious during convalescence, arrhythmia at times	2 months	Recovered	Mental examination showed it had been abnormal some years, not sequel of encephalitis

331	14 yrs. M.	?	Sudden	+	+	+	.....	—	102	+	Delirium.....	3 weeks	Recovered	
382	16 yrs. M.	—	Sudden	+	+	+	.....	—	To 106.6	—	.....	3 days	Died	
Y	18 yrs. M.	—	Sudden	++	++	+	.....	—	102	—	Slight delirium at times.....	3-4 weeks	Recovered	
24	20 yrs. M.	+	Slow	+	+	+	Rt. facial	—	103	—	Paralysis after 1 week, delirium	1 month	Recovered	
48	20 yrs. M.	—	Sudden	+++	+++	+	Dysphagia	—	103	..	Leg spastic, marked sweating, mask-like expression, tremors, delirium	1 week	Died	
353	23 yrs. M.	+	Slow	++	++	+	.....	++	+	+	.....	1 month	Recovered	
393	25 yrs.?F.	+	Slow	+++	+++	+	Facial	.....	103	+	Pregnant, normal delivery, delirium at times	Over 2 months	Recovered	
66	30 yrs.?M.	+	Slow	+++	+++	++	Double facial	++	99-103	—	Restlessness, marked tremors, mask-like expression	6 weeks	Recovered	
103	30 yrs. M.	+	Slow	+	+	+	Left facial	N.	—	—	Disturbance of vision, vacant expression, delirium at times	?	Recovering	
27	32 yrs. M.	+	Slow	+++	+++	+	Bilat. facial	D.	102	—	Nystagmus, dizziness, diplopia, tremors, mask-like expression, spasticity	4 months	Recovered	
59	35 yrs. M.	—	Slow	++	++	+	Left facial Dif. speech, arm and leg paralyzed	++	101-102	—	Diplopia, difficult speech, dizziness	2 months	Recovering	Mental depression, slight paralysis
72	43 yrs. M.	+	Sudden	++	++	+ mostly on left side	Rt. arm	N. left D. rt.	—	—	Dizziness, diminished sensitiveness on right upper and lower extremities	2 weeks	Recovering	Slight weakness
392	45 yrs. M.	+	Slow	++	++	+	Ptosis of rt. eyelid	++	103	—	Babinski incontinance, sweating, mask-like expression, delirium	4 months	Recovered	Rapid pulse
68	50 yrs. M.	—	Slow	+++	+++	—	Sl. ocular	D.	Slight	—	Babinski, mask-like expression	3 months	Recovered	
X	50 yrs.?M.	+	Slow	—	+	+	Facial Dif. speech	—	+	+	Irritability, pain, restlessness	3 mo.; facial par. after 5 mo. nearly gone at 6	Practically recovered	Slight paralysis remaining
52	50 yrs. M.	—	Sudden	++	++	+	.....	N.	Slight	—	.....	1 month	Died	

well-marked stiffness of the back, but he still had fever, his patellar reflexes could not be obtained, and there was a moderate Kernig's and Macewen's sign. Lumbar puncture revealed clear fluid under pressure showing only a slight increase in the proteid contents. The case cleared up quite promptly.

CASE 2.—Patient 66 was a physician about 30 years of age. He had an attack of influenza which began February 18 and lasted for six or seven days. While there was general improvement after the attack, he continued to suffer with severe headache, and late in February he began to have fever, which ran as high as 103 F., and marked apathy. I saw him March 12. His face was entirely expressionless and he made no response whatever when requested to smile; apparently there was great weakness of the facial muscles on both sides. At times there was ptosis. He was unable to move, but frequently asked to be turned as he was uncomfortable if left long in one position as a tremor involving all the limbs was then most likely to develop. His pupils were equal and reacted to light; the knee jerks were slightly increased and he was entirely clear mentally and very anxious about his condition. As Dr. Foster Kennedy very aptly expresses it, these patients are emotionally stuporous and intellectually bright. About 35 c.c. of clear spinal fluid was withdrawn, showing great increase in cells and proteid contents; a negative Wassermann test was made. He was able to be out of bed by the end of March and after another month had quite recovered, though he was still a little weak and suffered slightly from insomnia.

CASE 3.—Patient 393, five months pregnant, had an attack of influenza two weeks before the onset of the encephalitis, which began gradually early in December with headache, chill and fever, vomiting, sweating and delirium. I saw her December 14, at which time she was stuporous. There was some stiffness of the neck, and a right facial paralysis. About 25 c.c. of clear spinal fluid were withdrawn, which showed great increase in cells and in the protein elements, and a negative Wassermann test. A guinea-pig inoculated with the fluid gave a negative reaction for tuberculosis. Her condition remained the same for two weeks or more and then she gradually recovered. The facial paralysis cleared up, and she had a normal delivery at term.

CASE 4.—Patient 38, a boy of 11 years, was seen February 4. Late in January he had what had been diagnosed as a mild attack of influenza. On the 31st he began to have gradually increasing headache, apathy, and low fever. When examined, February 4, he was stuporous, the pulse rapid (120), and quite arrhythmic. His temperature was between 100 and 101 F. The right pupil reacted sluggishly to light, the left was normal. The right patellar reflex was increased, and there was a right facial paralysis. Fifteen c.c. of spinal fluid withdrawn on this occasion and 25 c.c. withdrawn two days later showed slight increase in cells, albumin and globulin. The Wassermann test was negative. The patellar reflexes became equal in a few days. By the 11th he was greatly improved. The stuporous condition had disappeared, and the pulse, though still rapid, had ceased to be arrhythmic. Later, however, he became mentally disturbed and was violent. By the middle of April, he seemed

to have recovered, but his mother reported that he had a voracious appetite and was very troublesome and difficult to manage. At first it seemed that his condition was due to the encephalitis but an investigation of the case revealed the fact that he had been in classes for atypical children for two or three years. He was examined by Dr. Coffin of the department of education for New York City, and was found to belong to the hyperactive, precocious type of children that it is so difficult to deal with satisfactorily.

CASE 5.—Patient 46, a boy of 9 years, is of interest on account of the long duration of his disease. He was admitted to Willard Parker Hospital with a history of being ill for three days. He was then comatose, had slight rigidity of the neck and Kernig's sign, exaggerated knee jerks, positive Brudzinski sign and Babinski reflex. He ran an irregular temperature, from 100 to 103 F. until February 19, after which it was below 100 until March 14. At times his pulse and respiration were irregular. He became progressively worse and by February 20 had marked rigidity of the entire body, and a mask-like, expressionless face. He became unable or unwilling to swallow and had to be tube fed. The white blood count was 15,000, 81 per cent. polymorphonuclears. The first lumbar puncture, February 13, showed a clear fluid with moderate increase in cells, 60 per cent. polymorphonuclears, moderate increase in protein elements, normal reduction in Fehling's sign and negative Wassermann test. Fluid withdrawn February 14, was slightly blood-tinged so that it had a somewhat hazy appearance. Therefore, with the clinical picture resembling meningitis so strongly, and an excess of polymorphonuclears in the first fluid, serum was given. Of course, this obscured the spinal fluid picture for some time. During all this time the child did not speak and has not up to the present time. There were frequent muscular twitchings. Early in March he began to move his head and a little later his legs and arms, and seemed to be progressing toward recovery. On March 14, however, the temperature rose to 106 F., he perspired profusely and seemed to be in a desperate condition. A blood culture at this time was negative. Twenty c.c. of spinal fluid were withdrawn under some pressure, showing a moderate increase in cells, 80 per cent. mononuclears, increase in albumin and globulin, and a normal reduction of Fehling's. On March 15 he began to improve; his temperature dropped to 100 F. Since that time his condition has shown some improvement, and he has gained in weight. A peculiar hairiness has appeared on the trunk, legs, arms and forehead. He looks about and has an intelligent expression but does not respond in any way when spoken to. He still has to be tube fed but can swallow if one is dexterous enough to insert food when his mouth is open. His arms, and especially his legs, are still somewhat spastic and the right leg shows contracture, though it is now possible nearly to straighten it without his evidencing much discomfort. Being naturally optimistic, we are expecting his ultimate recovery.

CASE 6.—The patient (48) 20 years old, became ill while he was in a hospital being treated for flatfoot. The onset, which was sudden, came on February 13, with severe pain in the chest, side, and shoulder, temperature of 102 F., pulse from 80 to 100. February 14 the condition was about the same except that he

complained of pain in his eyes and during the night he became irrational. On the 15th and 16th the condition became worse, with severe headache and active delirium. His jaw was so rigid that his throat could not be examined and the arms and legs became spastic. There was slight rigidity of the neck and the Kernig sign was present, which may have been due to the general spasticity. The patellar reflexes were present, the pupils reacted rather sluggishly to light, there were a few large, moist râles in the right base posteriorly and no bronchial breathing. The pulse was rapid and of poor quality at times. His temperature went as high as 104 F. A diagnosis of cerebrospinal meningitis was made and an unsuccessful attempt was made to perform a lumbar puncture. The patient was sent to the Willard Parker Hospital on the evening of February 16. Twenty c.c. of clear fluid were withdrawn showing a moderate increase in cells and mononuclears, albumin and globulin greatly increased, and a normal Fehling's reduction. There were no organisms by smear or culture and a negative Wassermann reaction. The second puncture, February 19, showed practically the same picture except that there was a greater increase in cells. The blood count was normal, 10,000 leukocytes, 65 per cent. polymorphonuclears. His temperature ranged from 103 to 105 F. His pulse was between 120 and 130, but was not irregular until slightly before his death, which occurred February 20. He lay on his back with his eyes tightly closed and his whole body markedly spastic. His neck was rigid. It was impossible to obtain the knee jerks, but the plantar reflexes were increased. At times there was a tremor, especially of the legs. He was generally comatose but at intervals there was muttering delirium, and he frequently perspired freely. He was able to swallow until near death though he often refused unless urged to do so by one of the nurses whose directions he usually followed. His death was described as being particularly painful with evidences of respiratory difficulty, probably of central origin, since it did not develop until shortly before he died. There was no evidence of paralysis at any time. A necropsy was performed which showed marked congestion of all the organs. The report on the brain and upper part of the cord will be given under pathology.

CLINICAL PICTURE

The characteristic clinical picture of lethargic encephalitis is generally as follows: a gradual onset, often following influenza, a low irregular fever, headache, marked lethargy and asthenia, with or without cranial nerve palsies.

TREATMENT

While there is no specific treatment, a lumbar puncture has been followed in many cases by temporary improvement. The spinal fluid is usually under increased pressure and it seems to me desirable to relieve

it. Of course, every effort should be made to keep the patient comfortable and general eliminative and supportive measures should be carried out. Symptomatic treatment should be instituted as the indications arise.

LABORATORY FINDINGS

The blood picture is not characteristic. It is usually normal or shows a slight leukocytosis, perhaps up to 15,000. Blood cultures are sterile. The urine is usually negative (Table 2). The spinal fluid shows practically the same picture as in poliomyelitis. The cells are usually slightly or moderately increased, seldom greatly, perhaps up to 150 to 200 in some cases. While cell counts may run higher in poliomyelitis, the great majority do not. As in poliomyelitis, there is usually an excess of mononuclears, but an excess of polymorphonuclears may occur. The albumin and globulin are greatly increased, the reduction in Fehling's is normal. The increase in cells and protein content is not always in the same ratio. No organisms are shown by smear or culture. The gold chlorid curve depends on the amount of albumin and globulin present and duplicate curves may be selected from those in poliomyelitis fluids. In some instances, most often in convalescent or mild cases, the findings may depart little from the normal. This is true also in poliomyelitis. Most reports of encephalitis show that the cell count (which, unfortunately, is often the only information given) falls off very quickly. In two of our cases of long duration, the character of the fluid did not change materially over a period of several weeks, but the condition of the patients also showed little change. This comparison with poliomyelitis is made, not because I believe the two diseases are at all identical, but to emphasize the fact that in each instance the spinal fluid is not specific, but shows the reaction of the meninges to an inflammation of the brain substance. A somewhat similar condition exists in the various syphilitic involvements of the central nervous system, but in these conditions the gold chlorid curve and the Wassermann test are helpful in making the diagnosis.

The most difficult and the most needed diagnosis is that made from the fluid of tuberculous meningitis. While generally the number of cells and the increase in albumin and globulin is greater in the latter disease, it is by no means always so, and it is sometimes necessary to

examine more than one fluid before one can be certain of the diagnosis, as it is often difficult to find the tuberculosis bacillus in early tuberculous meningitis and the reduction of Fehling's may be normal at that time. The following table shows the findings in the spinal fluids in our cases of lethargic encephalitis.

The inoculation of monkeys with the emulsified brain and cord of fatal cases has given far from uniform and conclusive results. The English reported failures in their attempts, though the same workers had been almost uniformly successful in dealing with material from cases of poliomyelitis. Von Weisner reported an instance in which the infected monkey died in forty-six hours, his brain on necropsy showing gram-positive cocci. The short period of incubation and the finding of the organisms make it much more probable that the monkey died from bacterial infection than from encephalitis. Flexner reported inconclusive results; Strauss, Hirshfeld and Loewe have published a preliminary report that indicates that the disease may be reproduced in monkeys by inoculation. I regret that up to the present time the lack of monkeys has made it impossible for us to do any work along this line at the research laboratory.

PATHOLOGY

Lethargic encephalitis belongs to the class of inflammatory diseases, in which also are included poliomyelitis, syphilitic lesions of the central nervous system and trypanosomiasis. While these different diseases have, broadly speaking, certain characteristics, the cases in a given class differ so widely that it is difficult, if not impossible, to accurately diagnose, by a study of the pathology alone, the less typical cases.

The meninges are usually described as showing only slight changes — an increase in the cellular elements particularly in the neighborhood of the blood vessels of the pia-arachnoid.

The cerebral cortex is generally normal except for congestion of the vessel of the leptomeninges.

In the brain substance, the changes are most marked in the basal nuclei of the brain, the upper part of the pons and peduncles, the gray matter of the floor of the fourth ventricle, and the aqueduct of Sylvius. The changes in the medulla and cord are often reported as less pronounced, though observers have noted the same changes occurring in the upper section of the cord. This was certainly observed

TABLE 2.—Laboratory Findings in Cases of Lethargic Encephalitis

Case No.	Amount in C.c.	Cytology	Protein	Fehling's Reduction	Animal Inoculation	Wassermann Reaction	Onset to Puncture	Gold Chlorid
14	30	Greatly increased..... Mononuclears 80%	+++	+++	.....	.....	?	
388	25	Greatly increased..... Mononuclears 90%	++++	.....	—	.....	3 days	
368	15 sl. cloudy	Greatly increased..... Mononuclears 90%	++	+++	.....	.....	3 days	
32	60	Greatly increased..... Mononuclears 80%	++ 1	+++	—	—	14 days	1234321000
	35	Greatly increased..... Mononuclears 80%	+++	+++	.....	.....	15 days	
	30	Slight to moderate increase. Monos. 90%	+++	++	.....	.....	16 days	
	30	Greatly increased..... Mononuclears 80%	++++	++	.....	.....	18 days	
5								
9	30	No increase.....	+ 1	+++	.....	.....	5 days	
371	10	Greatly increased..... Mononuclears 80%	++	+++	.....	.....	18 days	
94								
49	12	Slight increase.....	±	+++	.....	.....	4 days	
54	5	Slight increase.....	+ 1	+++	.....	.....	5 days	
16	30	No increase.....	+	+++	.....	.....	?	
87	20	Very great increase..... Mononuclears 90%	+	+++	—	.....	4 days	
351	20	No increase.....	++ 1	+++	.....	.....	4 days	
137	10	No increase.....	+ 1	+++	.....	.....	3 days	
391	25	Slight to moderate..... Mononuclears 90%	+ 1	+++	—	—	7 days	
395	15	Slight increase.....	+	+++	.....	.....	4 days	
19	35	Moderate increase..... Mononuclears 90%	++	+++	.....	—	4 days	
41	20	Greatly increased..... Mononuclears 95%	++ 1	+++	.....	.....	3 days	
80								
357	35	No increase.....	+	+++	.....	.....	14 days	
46	15	Moderate increase..... Polys. 60%	++	+++	.....	—	3 days	
	25	Bloody fluid.....	++	+++	.....	.....	4 days	
	30	Bloody fluid.....	++ 1	+++	.....	.....	5 days	
	20	Moderate increase..... Mononuclears 80%	+++	+++	.....	.....	6 days	
	20	Moderate increase..... Mononuclears 80%	++	+++	.....	.....	8 days	
	15	Moderate increase..... Mononuclears 95%	++	+++	.....	.....	32 days	
	20	Slight to moderate.....	+++	+++	.....	.....	50 days	
35	10	Moderate increase.....	+++	+++	.....	—	2 days	
100	20	Very great increase..... Mononuclears 90%	++++	++	—	—	2 days	
	30	Great increase.....	++++	+	.....	.....	4 days	
38	15	Slight increase.....	+	+++	.....	—	4 days	
	25	Slight increase.....	+	+++	.....	.....	6 days	
331	30	Slight increase.....	+	+++	.....	.....	21 days	
382	20	No increase.....	+	+++	.....	—	1 day	
Y								
24	25	Greatly increased..... Mononuclears 80%	++ 1	+++	.....	.....	14 days	
48	20	Moderate increase..... Mononuclears 60%	+++	+++	.....	—	?	
	20	Greatly increased..... Mononuclears 80%	+++	+++	.....	.....		
353	5	Slight increase.....	++	+++	.....	.....	3 days	
393	25	Moderate increase..... Mononuclears 85%	++ 1	++ 1	—	—	10 days	
66	30	Moderate to great incr.	++ 1	+++	.....	—	15 days	
108								
27	30	Moderate increase..... Mononuclears 80%	+ 1	+++	.....	—	2 days	1232100000
59	25	Moderate to great incr.	++ 1	+++	.....	—	14 days	
72	25	No increase.....	+ 1	+++	.....	.....	3 days	
392	20	Greatly increased..... Mononuclears 90%	++	+++	—	—	10 days	
	25	Greatly increased..... Mononuclears 80%	++	++ 1	.....	.....	18 days	
	35	Moderate increase..... Mononuclears 80%	++	+++	.....	.....	20 days	
	20	Moderate to great incr. Mononuclears 90%	++	+++	.....	.....	44 days	
68								
X	30	Slight increase.....	+++	+++	.....	—	7 days	00012455560
52	30	Moderate increase.....	+	+++	.....	—	17 days	

in the case of 48, which came to necropsy. To the localization in the mesencephalon, particularly in the vicinity of the nucleus of the third nerve, McNalty attributes the stupor, since a lesion in this locality cuts off the afferent stimuli. The relation of the paths of the rubrospinal and pyramidal tracts to the region of the nucleus of the third nerve also explains the tremor and the frequent presence of the Babinski sign. It must be borne in mind that a virus affecting the nervous tissue, although it may have a predilection for a certain part of the central nervous system, may attack any part.

The lesions are generally described as consisting of four kinds:

1. Infiltration of the walls of the small vessels with lymphocytes and plasma cells.

2. Foci of interstitial and parenchymatous infiltration with round cells. In this reaction neuroglia cells may take part.

3. Lesions of the nerve cells—usually not so extensive as in poliomyelitis, and with less neuronophagia. These lesions of the cells usually occur when the inflammatory process takes place in the gray matter, but they may develop in the absence of any inflammatory reaction. Such is the case with regard to the cells of Purkinje in the cerebellum where inflammatory changes are almost entirely absent.

4. Foci of perivascular hemorrhage. The vessel walls are usually not necrosed.

In connection with the statement that lesions of the cells may occur in regions where there is no evidence of inflammatory reaction, it is interesting to recall that Abramson, in a very excellent study of the pathology of poliomyelitis made at the research laboratory during the epidemic of 1916, brought out the same fact in regard to the lesions of poliomyelitis.

Perhaps an idea of the pathologic picture may best be obtained by a description of a case, No. 48. The brain was studied at necropsy by Dr. Alexander Fraser of Bellevue Medical School, to whom I am indebted for the following report.

MACROSCOPIC

The pia-arachnoid of the whole brain, including the medulla oblongata and a small part of the spinal cord accompanying it, shows marked congestion of the vessels and numerous small hemorrhages.

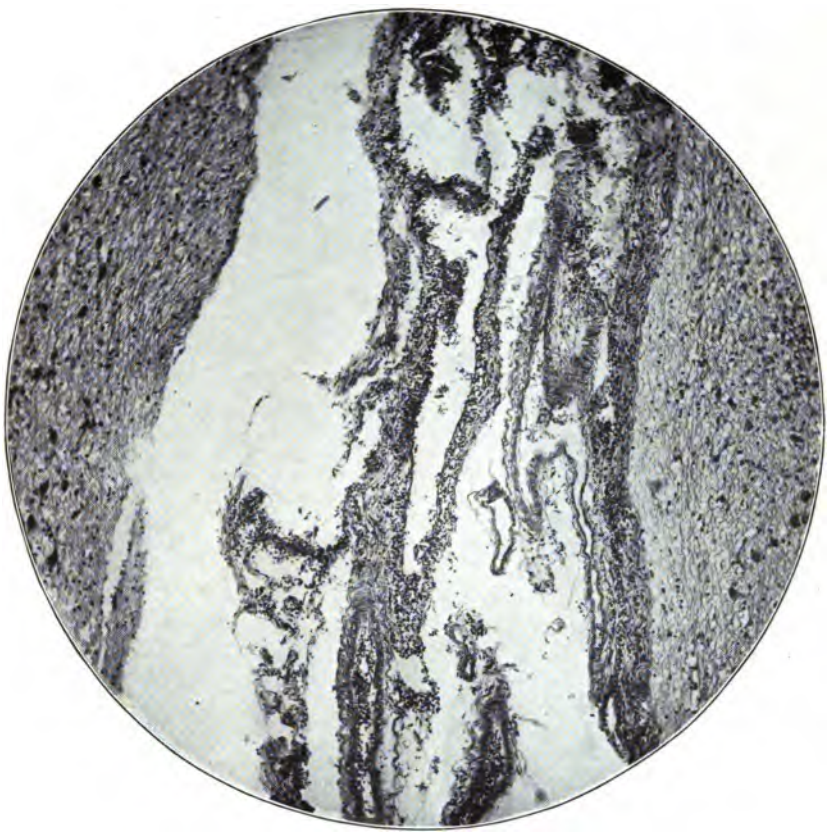

Fig. 1.—Meninges of the anterior fissure of the cord, showing fibrosis and round-cell infiltration, mostly in the vessel walls. Diffuse round-celled infiltrations of the arcuate nucleus of the pyramids is shown in either side.

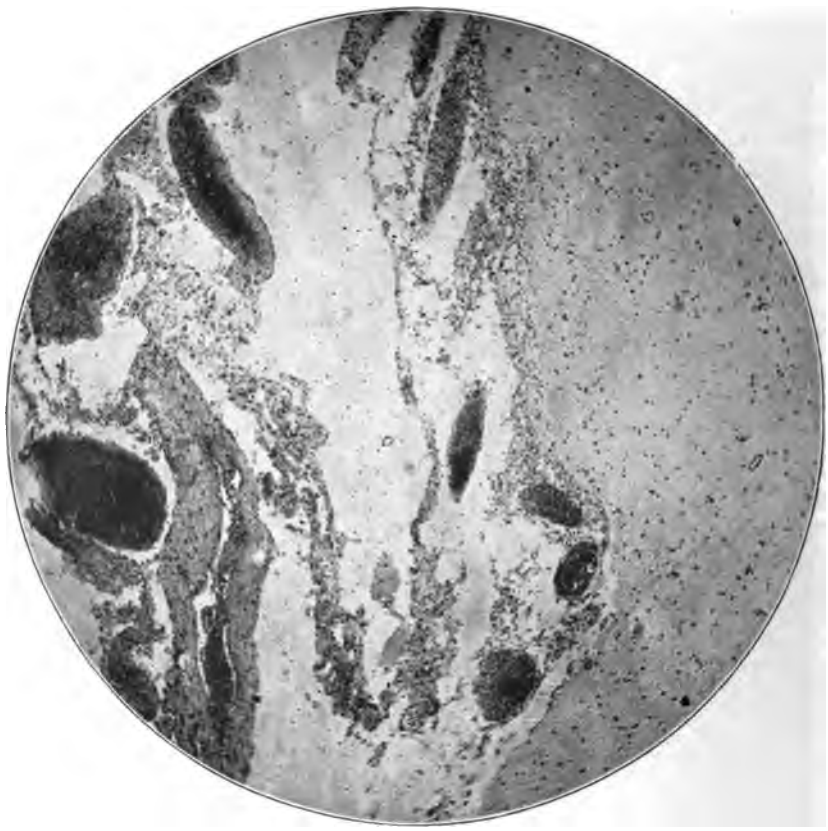

Fig. 2.—Meninges of the cortex showing marked injection of the vessels and hemorrhage invading the cortex for a short distance. The cortical tissue otherwise is negative.

Fig. 3. — Cord, just below the olivary body, showing dense perivascular, round-celled infiltration and edema.

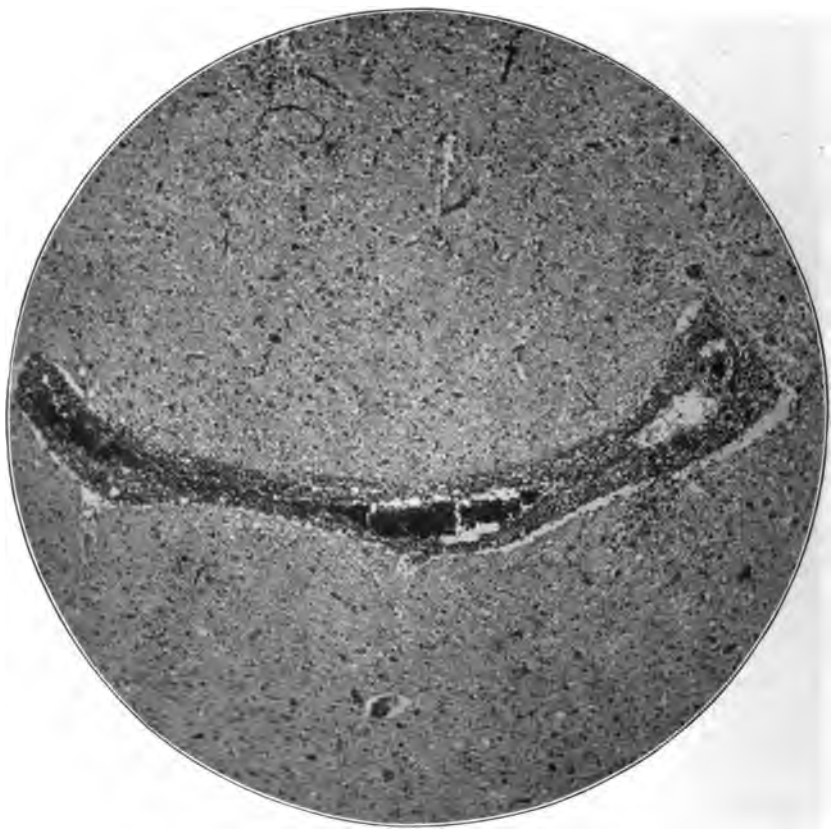

Fig. 4.—Cord, a higher level, showing dense perivascular and also diffuse round-celled infiltration.

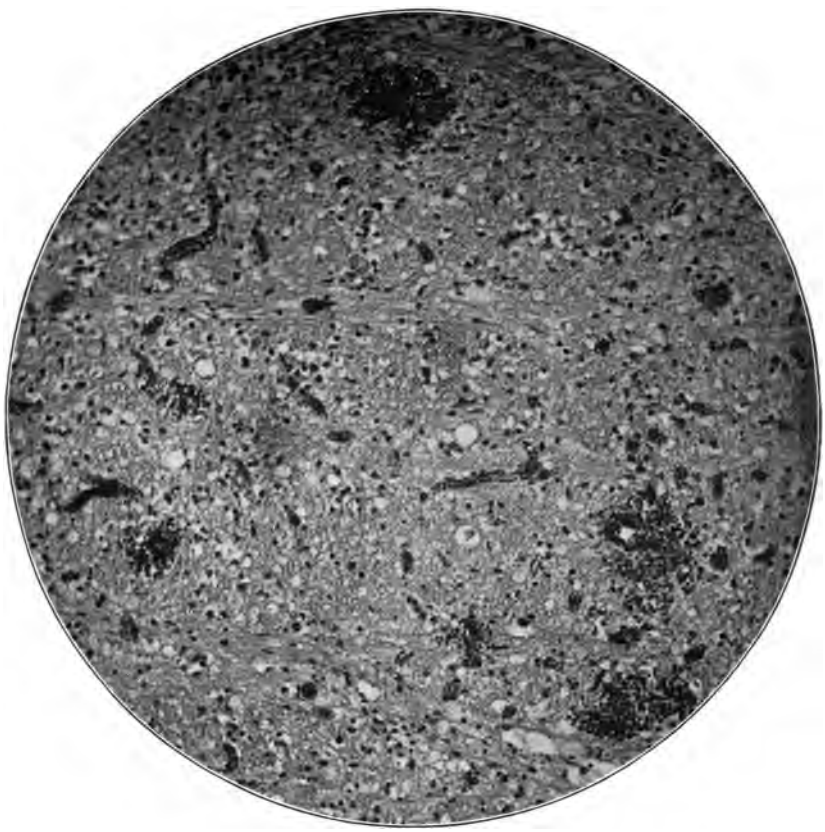

Fig. 5.—Medulla oblongata showing numerous petechial hemorrhages, diffuse round-celled infiltration and degeneration of ganglion cells.

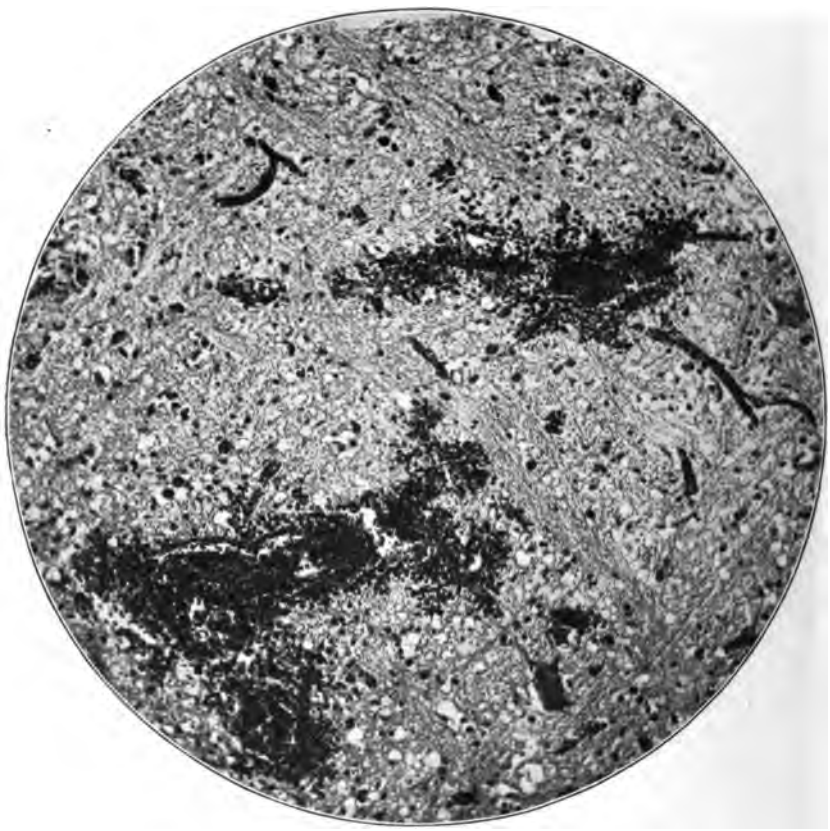

Fig. 6.—Another section from the medulla showing larger hemorrhages.

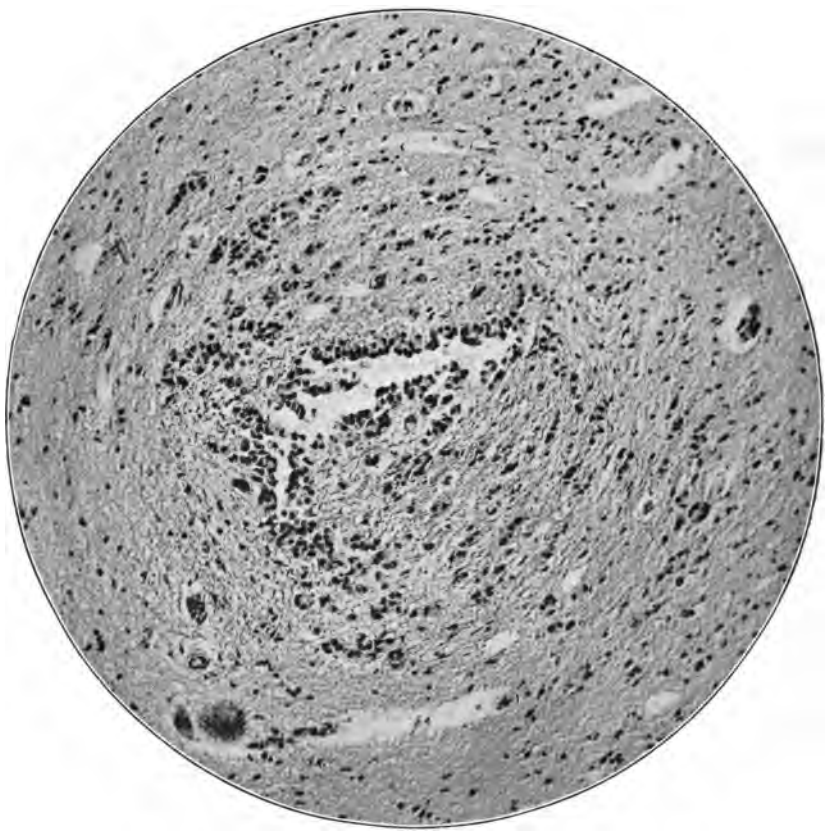

Fig. 7.—Section of the cord showing central canal. Note disintegration of the epithelium and exudate in the lumen.

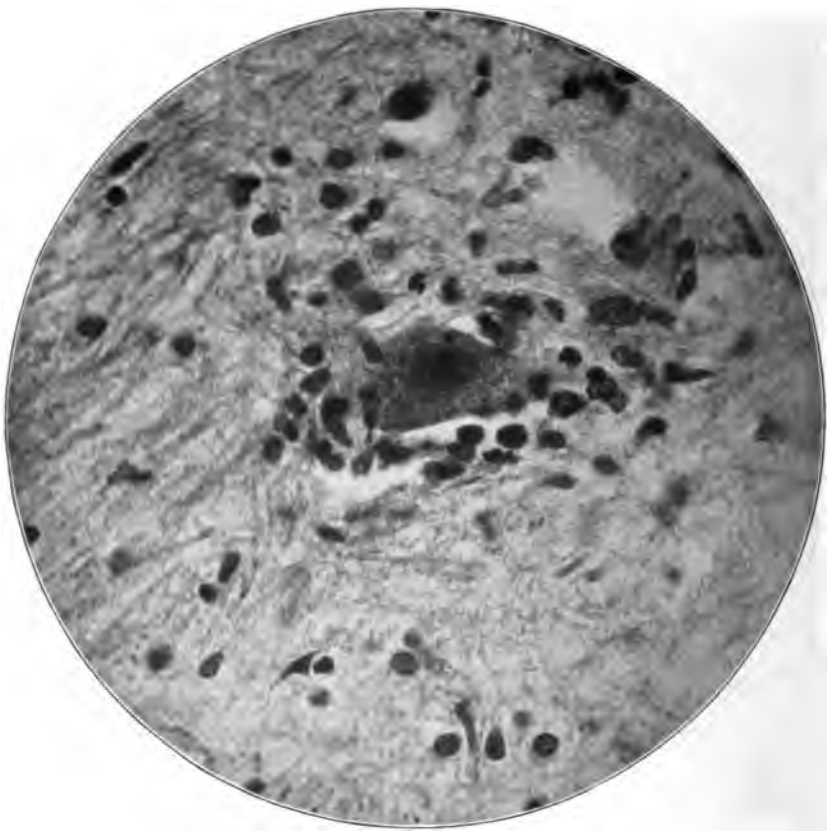

Fig. 8.—Same section as Fig. 7. Ganglion cell undergoing disintegration surrounded by phagocytes.

The portion covering the medulla, pons and peduncles is considerably thickened and brownish-gray in color. No free exudate is present. The brain tissue is firm in consistency. On section, the cerebral hemispheres show considerable distention of the vessels with blood and an occasional small splotchy hemorrhage especially in the outer cortex.

The ventricles seem large, but contain little fluid which is of a reddish tinge. The ependyma, especially over the thalamus and floor of the fourth ventricle is lustreless, dull grayish-white in color and "mushy." In one place in the fourth ventricle it projects into the cavity in the form of a polypoid mass. The choroid plexus of the lateral ventricles is markedly congested and in places cystic. Section of the cerebellum shows distended vessels but apparently no hemorrhages. Section of the medulla, pons, crura and basal ganglions shows very marked distention of the vessels with numerous small and a few fairly large, irregularly outlined extravasation of blood.

The color of the tissue in these regions is a fine and irregular mottling of dull gray and white. These features are especially marked just beneath the floor of the fourth ventricle.

MICROSCOPIC

The pia of the cerebrum and cerebellum shows distention of the vessels with blood, round cell infiltration especially marked around and in the vessel walls, thrombosis and hemorrhages. Only very rarely does the perivascular infiltration follow the vessels into the brain substance, and then only for a short distance. Occasionally, a hemorrhage from one of these vessels is seen in the outer part of the cortex. In such areas the ganglion cells show various degrees of degeneration.

In the medulla, pons and basal ganglions, the pia shows the same pathologic features, but in a much more marked degree. In these regions, too, the perivascular infiltration follows the vessels deeply into the brain tissue, and focal and diffuse areas of round cell infiltration are scattered throughout the tissue apart from the vessels. Frequent small and occasional large extravasations of blood are seen anywhere, but especially in the gray matter.

The cellular infiltrations, too, are practically always in the gray matter. The cells of the infiltrate are mostly lymphocytes with a few plasma cells and an occasional large mononuclear.

The blood vessels, though densely infiltrated, show no endarteritis.

In the affected areas, ganglion cells are seen in all stages of disintegration, some having been completely destroyed and replaced by groups of phagocytes. Sections stained by the Levaditi method were negative.

CONCLUSIONS

1. The histologic picture of the condition is that described by English authors for lethargic encephalitis, also that of trypanosomiasis.

2. The picture is very much like poliomyelitis, but such extensive infiltration of meninges and larger vessel walls would, at least, be very unusual.

3. The picture is also very much like syphilis. In syphilis, however, the infiltration sticks to the vessels. Syphilis shows an endarteritis, and usually gummata in vessel walls.

POSSIBLE RELATION TO POLIOMYELITIS AND INFLUENZA

Three theories have been advanced to explain the occurrence of lethargic encephalitis. When it first appeared in England, it was suggested that it was caused by food — botulism or some poison derived from substitutes or solanin accumulating in sprouts of potatoes or other vegetables. This theory has been definitely disproved and discarded. According to a second theory, it is a form of poliomyelitis; and, according to a third, it is connected with the epidemic of influenza.

The theory that it is a form of poliomyelitis has not been definitely proved or disproved. Epidemic poliomyelitis usually occurs in hot weather, the majority of the victims are children, and the lower motor neuron type of paralysis constitutes the great majority of the cases with paralysis. The onset is usually sudden and the greatest number of deaths occur in the first week. Lethargic encephalitis has occurred in its present appearance during the cool weather, the majority of cases having been adults (my own list of cases shows a large number of children, but this is undoubtedly because I am so often called to see the milder type of case where tuberculous meningitis is suspected). Very few cases of the lower motor neuron type of poliomyelitis are occurring, and among the cases diagnosed as lethargic encephalitis there are evidences of involvement of the higher centers in the way

of cranial nerve palsies and prolonged lethargy which are rare even in epidemics of poliomyelitis. Certainly among the hundreds of cases of the latter disease that came under my observation during the epidemic of 1916 there were no cases at all approaching the characteristic picture of lethargic encephalitis, and only a few of the encephalitic type of poliomyelitis, with which some of these milder cases might easily be confused. Moreover, in lethargic encephalitis the onset is usually slow, and death occurs oftenest in the third week. The similarity of the spinal fluid findings is of little significance, since in neither case are they specific. The same may be said in regard to the pathology, though here there are, as a rule, more points of difference. As regards animal inoculation, it is certainly much more difficult to reproduce the disease in monkeys than is the case in poliomyelitis. For all these reasons it seems to me probable that lethargic encephalitis is not a form of poliomyelitis though the causative agents in the two diseases may perhaps be closely allied.

In regard to the possible relation between influenza and lethargic encephalitis, the evidence is as yet entirely circumstantial. In the first place, attention may be called to the fact brought out by historical study that on several occasions epidemics of a disease resembling lethargic encephalitis and influenza have occurred together. The impression is gained from these studies that encephalitis has not appeared in anything like an epidemic form except with influenza. It is certain that in their last appearance, 1889-1890, they occurred simultaneously, and it would seem that enough time has elapsed since for either to appear by itself if there were no direct connections between them. Then again, in a large proportion of cases, occurring in this country at least, the onset has been preceded by an attack clinically influenza. Moreover, that influenza has a marked effect on the central nervous system is shown in two ways: First, in nearly every instance, the convalescence from influenza is characterized by a profound mental depression and nervous exhaustion out of all proportion to the severity of the disease; secondly, as indicated by the reports of Jelliffe, Menninger, Burr and others, influenza is far more likely than any other acute infection to be followed by disturbances of the nervous system either psychic or organic. Therefore, it seems to me probable that there is a definite connection between influenza and lethargic encephalitis. Just what the relation is, I am not prepared to

state. In view of the fact that we do not know the cause of either disease, one cannot say that the two diseases have the same origin. The causative agents may be identical or closely allied or the virus causing influenza may make the individual more susceptible to the causative agent of encephalitis or it may enhance its virulence. It is easy to speculate on the unknown.

BIBLIOGRAPHY

Report of an Inquiry Into an Obscure Disease, Encephalitis Lethargica, Local Government Board on Public Health and Medical Subjects, n. s. 121, England.

Von Economo: Wien. klin. Wchnschr. **30**:581, 1917.

Von Economo: Neurol. Centralbl., 1917, No. 21.

Harris: Lancet **1**:568 (April 20) 1918.

Hall: Lancet **1**:568 (April 20) 1918.

Batten and Still: Lancet **1**:636 (May 3) 1918.

Netter: Societe med. des Hôpitaux **34**:307 (March 22) 1918.

Netter: Bull. de l'Acad. de méd. **79**:337 (May 7) 1918.

Jelliffe: New York M. J. **108**:725 (Oct. 26) 1918; **108**:755 (Nov. 2) 1918; **108**:807 (Nov. 9) 1918.

Bassoe, P.: J. A. M. A. **72**:677 (March 1) 1919.

Bassoe, P.: Epidemic Encephalitis (Nona) J. A. M. A. **72**:972 (April 5) 1919.

Neal, J. B.: Meningeal Conditions Noted During the Epidemic of Influenza, J. A. M. A. **72**:714 (March 8) 1919.

Pothier, O. L.: Lethargic Encephalitis: Preliminary Report, J. A. M. A. **72**:715 (March 8) 1919.

Ely, F. A.: Lethargic Encephalitis: Preliminary Report, J. A. M. A. **72**: 985 (April 5) 1919.

Mayer: Postinfluenzal Disturbances of the Nervous System, J. A. M. A. **72**:670 (March 1)1919.

Kennedy: Med. Rec. **95**:631 (April 19) 1919.

Public Health Reports, U. S. P. H. S. **34**: No. 8 (Feb. 21) 1919.

Encephalitis Lethargica: A New Disease? Editorial, J. A. M. A. **72**:414 (Feb. 8) 1919.

Epidemic or Lethargic Encephalitis (Nona), Special Article, J. A. M. A. **72**:794 (March 15) 1919.

Acute Infectious Polyneuritis—A New Disease, Editorial, J. A. M. A. **72**: 940 (March 29) 1919.

Burr: Med. Clin. N. A. **2**:709 (Nov.) 1918.

Menninger, K. A.: Psychoses Associated with Influenza: I. General Data: Statistical Analysis, J. A. M. A. **72**:235 (Jan. 25) 1919.

Bradford, Bashford and Wilson: Quart. J. Med. **12**:88 (Oct.) 1918 (Jan.) 1919.

Tucker, B. R.: Epidemic Encephalitis Lethargica, or Epidemic Somnolence, or Epidemic Cerebritis, with Report of Cases and Two Necropsies, J. A. M. A. **72**:1448 (May 17) 1919.

Sachs: New York M. J. **109**:894 (May 24) 1919.
Strauss, Hirshfeld and Loewe: New York M. J. **109**:772 (May 3) 1919.
Fell, E. W.: Postinfluenzal Psychoses, J. A. M. A. **72**:1658 (June 7) 1919.

DISCUSSION

DR. JOHN F. HOGAN, Baltimore: In Baltimore we wished to ascertain the number of cases of encephalitis lethargica, as only a few were diagnosed. I saw all of the cases reported to the health department and there was one constant symptom or rather complication. I think it should be classed as a complication rather than a symptom, because it comes on later in the progress of the disease. This constant complication of diplopia seemed to set in afterward, within three to five weeks after the onset. In all the cases that I saw, the complication was present or developed later. The first patient I saw was a big husky man, 20 years of age. I did not know what his trouble was. He had been sent to a camp in that vicinity because he was a member of the Dental Reserve Corps. In February or March I heard that this man had recovered. He had had a slight facial paralysis which afterward disappeared, and as I questioned him and read the article to him, which appeared about that time in the report of the Surgeon-General of the U. S. Public Health Service, and I described diplopia he said he had it. He spoke of attending a lecture at the camp and while at the lecture he thought he saw two lecturers on the platform and, in fact, questioned a soldier who was next to him and asked him if there were two persons on the platform. I wonder if others had the same experience.

INDEX

PAGE

Albert, H.: discussion on influenza 212
Bastedo, W. A.: discussion on influenza 220
Browning, C. C.: discussion on influenza 219
Chase, A. E.: discussion on venereal disease control 95
Conner, L. A.: paper on symptomatology and complications of influenza 142
Darnall, W. E.: paper on New Jersey's work in mosquito control 26
Discussion on same 38
Davin, J. P.: discussion on mosquito control 37
Discussion on tuberculosis mortality 59
Discussion on war and public health 24, 25
Drake, C. St.C.: paper on influence of war on preventive medicine and public health 17
Dublin, L. I.: discussion on influenza 78
Encephalitis, lethargic; paper by J. B. Neal 222
Discussion 237
Ferrell, J. E.: discussion on mosquito control 36
Franklin, A. L.: discussion on influenza 74
Freilich, E. B.: discussion on influenza 75
Frost, W. H.: paper on epidemiology of influenza 116
Goldstein, H. I.: discussion on influenza 216
Gram, F. C.: paper on influenza epidemic and its after-effects in city of Buffalo 62
Discussion on same 74, 79
Discussion on venereal disease control 96
Guiteras, J.: discussion on mosquito control 36
Discussion on tuberculosis mortality 59
Hartman, F. W.: discussion on influenza 213
Hastings, C. J.: discussion on influenza 78
Herrick, J. B.: paper on treatment of influenza by means other than vaccines and serums 204
Discussion on same 221
Hogan, J. F.: discussion on lethargic encephalitis 237
Influenza, bacteriology of recent pandemic of, and complicating infections; paper by W. H. Park 133
Discussion 210
Influenza epidemic and its after-effects in city of Buffalo; paper by F. C. Gram 62
Discussion 74
Influenza, epidemiology of; paper by W. H. Frost 116
Discussion 210
Influenza, experiments to determine mode of spread of; paper by M. J. Rosenau 109
Discussion 210
Influenza, status of prophylactic vaccination against; paper by G. W. McCoy 176
Discussion 210
Influenza, studies in pneumonia and; further results of prophylactic inoculations; paper by E. C. Rosenow and B. F. Sturdivant 158
Discussion 210

PAGE
Influenza, symptomatology and complications of; paper by L. A. Conner 142
Discussion 210
Influenza, treatment of, by means other than vaccines and serums; paper by J. B. Herrick 204
Discussion 210
Influenzal pneumonia, value of convalescent blood and serum in treatment of; paper by H. F. Stoll 188
Discussion 210
Kellogg, W. H.: discussion on influenza 77
Discussion on venereal disease control 95
Koons, H. H.: discussion on influenza 220
Lambert, A.: discussion on influenza 213
Le Count, E. R.: discussion on influenza 211
Lord, F. T.: discussion on influenza 217
Lumsden, L. L.: discussion on tuberculosis mortality 58
McCormack, A. T.: discussion on mosquito control 37
Discussion on tuberculosis mortality 60
McCoy, G. W.: paper on status of prophylactic vaccination against influenza 176
McLean, J. D.: discussion on mosquito control 37
Marcus, L.: paper on open air classes 99
Morrison, A.: discussion on open air classes 108
Mosquito control, New Jersey's work in; paper by W. E. Darnall.. 26
Discussion 36
Neal, J. B.: paper on lethargic encephalitis 222
Newsholme, A.: discussion on influenza 76
Nursing, demand for community service nursing during reconstruction period; paper by B. R. Wakeman 39
Open air classes; paper by L. Marcus 99
Discussion 108
Palmer, G. T.: paper on general health activities and their effect on tuberculosis mortality 54
Discussion on same 61
Park, W. H.: paper on bacteriology of recent pandemic of influenza and complicating infections 133
Pierce, C. C.: paper on progress of venereal disease control 80
Discussion on same 97
Discussion on war and public health 24
Pneumonia, influenzal, value of convalescent blood and serum in treatment of; paper by H. F. Stoll 188
Discussion 210
Pneumonia, studies in influenza and; paper by E. C. Rosenow and B. F. Sturdivant 158
Discussion 210
Public health, influence of war on preventive medicine and; paper by C. St.C. Drake 17
Discussion 24
Rawlings, I. D.: discussion on venereal disease control 96
Rosenau, M. J.: paper on experiments to determine mode of spread of influenza 109
Rosenow, E. C.: paper on studies in influenza and pneumonia 158
Discussion on same 220
Roussel, A. E.: discussion on influenza 217
Schools, open air classes; paper by L. Marcus 99
Discussion 108
Solis-Cohen, S.: discussion on influenza 215
Stoll, H. F.: paper on value of convalescent blood and serum in treatment of influenzal pneumonia 188

PAGE

Sturdivant, B. F.: paper on studies in influenza and pneumonia... 158
Tuberculosis mortality, general health activities and their effect on; paper by G. T. Palmer 54
Discussion 58
Vaughan, V. C.: discussion on influenza 76
Venereal disease control, progress of; paper by C. C. Pierce..... 80
Discussion 95
Wadsworth, A. B.: discussion on influenza 210
Wakeman, B. R.: paper on demand for community nursing service during reconstruction period 39
Discussion on influenza 75
Walter, W.: discussion on influenza 218
War, influence of, on preventive medicine and public health; paper by C. St.C. Drake 17
Discussion 24
Williams, A. W.: discussion on influenza 211
Wood, H. B.: discussion on influenza 77, 215
Woodward, W. C.: discussion on influenza 219
Discussion on tuberculosis mortality 60, 61
Wylder, M. K.: discussion on influenza 218

DL212